



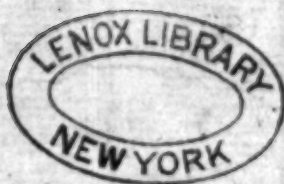
# ☞ The arte

*of Navigation,*  
Conteyning a compendious  
description of the Sphere, with the  
makynge of certayne Instrumentes  
and Rules for Navigations: and  
exemplified by many Demonstrati-  
ons. Written in the Spanishe  
tongue by Martin Cortes,  
and directed to the Em-  
perour Charles  
the first.

Translated out of Spanyshe  
into Englyshe by Richarde  
Eden, and now newly  
corrected and amen-  
ded in dyuers  
places.

1572.





To the ryght worshypfull Syr Wylliam  
 Garerd Knyght, and Maister Thomas Lodge,  
 Aldermen of the Citie of London, and Gouvernours of the honou-  
 rable felowshippe oꝝ societie, as well of certayne of the  
 Nobilitie, as of Parchauntes aduenturers, foꝝ the  
 discouerie of Landes, Territoꝛies, Ilandes,  
 and Seignozies vnknoſwen, and not  
 before theyꝝ first aduenture oꝝ en-  
 terpryse by Seas oꝝ Nauiga-  
 tions commonly fre-  
 quented.

And to the ryght woꝝshypful the Consulles,  
 Assistentes, and Comminaltie of the  
 same societie, Richarde Eden  
 wyssheth health and  
 prosperitie.



That so euer he was (right hono-  
 rable and woꝝshypful) that first  
 beleued that the frame and co-  
 aptation of the bodye of man,  
 with the functions, offices,  
 and duties, of the partes and  
 members of the same, knitte to-  
 geather in a certayne vnitie to a  
 common ministratiō, byd re-  
 present a lyuely image and similitude of a perfect common  
 wealth: I thynke that he was a man of no vulgar iudge-  
 ment, oꝝ abiecte minde, but rather of singular wysedome  
 and prudence in the contemplation of diuine and humane  
 thynges. Foꝝ he saue, that as in the small natyue seede  
 of all growyng oꝝ luyng thynges, is coneyned the  
 fourme that bringeth them to their perfection: so in cer-  
 teyne small and obscure members of the common wealth,  
 consisteth no small increase to the perfection of the whole.  
 He saue lykelyste that herein, as in the bodye of man,  
 representyng the partes and members of the woꝝlde (as  
 I haue sayde) are diuers partes of diuers and sundry

## The Preface.

actions & motions, greatly differing in forme, number, and quantitie, yet all the same to be so knytte together, and so to consent in one vniformitie, to the common profite of the whole, that a greater concozde and harmonie can not be imagined, then is proportioned by the freendely unitie of diuers and contrarpe. We saue likewise in the same, suche a mutuall compassion of parte to parte, and member to member, by one common sense existent in them all, that no one parte or member can feele eyther ioye or payne, but that in manner all the other are partakers thereof more or lesse, yf they be lyquely members, and not wythered, or otherwise vnensate by reason of dead fleashe, which onely by cutting and burning ought to be diuided from the sounde and whole. But as in man (whom Plato calleth the lesse worlde) the vigour and agilitie of the immortall soule and mynde, neuer ceaseth from continuall moouyng, but is euer exercised in excogitations and inuentions of greate thynges (here in resembling God, whose caracte it beareth) by prouidence foreseeing, and by intelligence vnderstanding, and deuising what is to be donne, and what to be eschewed, doeth immediatly mooue and rayse by the faculties, powers, and members of the bodye to execute the same: Euen so, in the greater worlde, the prouidence of God, and vniuersall counsaile and consente of menne, hath elected and appoynted certayne principall menne, to beare like rule and auctoritie in the bodye of the common wealth, as hath the intellectuall soule in the members of our bodye to mooue and commaunde the same. To Princes therefore, Counsaylours, Rulers, Governours, and Magistrates, as to the most intellectuall and sensitiue partes of the societie of menne, hath God and nature geuen preeminence and gouernance of the common wealth, that by theyr prouidence, wysdome, and ayde, it maye vniuersally flourish, not onely by iuste administration of good lawes, with due correction of malefactorrs, but also by liberall rewardeing of suche as haue well deserued: and especially by maynteynauce of suche artes and sciences, as the  
common

## The Preface.

common wealth can not well be without. And to declare  
nearer to the applying of my similitude : I say, that  
what so euer vertue, what so euer art, or the ingenious  
industry of manne, hath to this day inuented, all the same  
is to be imputed to the beneuolence and liberalitie of  
suche as haue honourably mainteyned and freely re-  
warded the trauiayles, paynes, and charges of them that  
haue spent their liues, goodes, and wittes (as ma-  
nye haue donne) in the inuentions of necessarie and pro-  
fitable artes and sciences. For euen as wholesome and  
temperate ayre, with seasonable weather, and fauourable  
influence of the heauens and planettes, causeth frutesful-  
nesse on the earth, and contrarywise, barrennesse by the  
contrary : Euen so the fauour of Princes and Magistra-  
tes, nourisheth, augmenteth, and amplyfieth, all artes and  
sciences by liberalitie, and extinguisheth the same by  
miserable couetousnesse and parcimonie. And although  
in some manne of rare and noble nature, the desyre of ho-  
nour and fame onely for vertues sake, and studie towarde  
theyr countrey and common wealth, hath moued them,  
in manner to theyr owne vndooyng, throught theyr great  
losse and hynderaunce, to set forth and inuente diuers  
thynges for the commoditie of the common wealth and  
other, rather then for theyr owne: yet vndoubtedly, who  
so wel consydereth, and indifferently wayeth that I haue  
sayde, shall fynde and see by dayly experience, that in  
manner onely munificence, liberalitie, and rewarde, or  
the hope thereof, geueth spurres to them that attempte  
great and vertuous enterpryses, as I coulde moze large-  
ly proue by so many testimonies of Hystories, both holye  
and prophane, that the rehearsall thereof shoulde be but  
tedious, and not greatly necessarie for my purpose,  
especially wrytyng vnto your honours and worthynnes,  
of whose munificence and liberalitie, I haue had greate  
experience, both in my selfe, and others, who by your  
ayde and mainteynauce, haue attempted, and perfor-  
med many goodly inuentions, viages, navigations, and  
discoueries of Landes and Seas, heretofore vnknowen.  
At heren,

## The Preface.

Wherein, what greate charges you haue suffeyned, and howe liberal and constant you haue ben in furthering the same, doth wel declare that hytherto you are rather losers then gayners thereby. The whiche thyng doubtlesse, is the moze to your commendation, in that it may hereby appeare that you haue attempted the same, rather for knowledge and vertues sake, then for couetousnesse of gaynes: as is furthemoze well knownen by your fyrste viages of discouerie attempted to Cathaye, by the Northeast Seas, vpon certaine losse & detriment, for vncertaine hope either of gaynes, or of any such way to be found, other wise then by certaine likely coniectures: not much vnylike to the shynning flowres of Parchytes, whiche outwardely appearing in mineral mountaynes, are signes & tokens wherby is coniectured what metal is conteyned therein, & whether the same is to be folowed or not. And although it sometime so chaunce, that suche signes are fayleable, shewing moze in appearance, then they conteyne in substance: yet are not such signes, tokens, or shewes to be cōtemned, but rather earnestly to be folowed, for as much as it hath ben often proued, & found by experiance, that by folowing the same, haue ben found greal and rich mynes of metalles: as Georgius Agricola in his booke De rebus metallicis, doth largely declare and proue by manye examples. But to wyte at large what greate thynges haue proceeded of smal and obscure begynnynge, and in manner mere coniectures: it woulde so farre excede the measure of an Epistle or Preface, that it woulde rather encrease to the iuste quantitie of a booke. For in manner all the late discoueries both of the Spanyardes and Portugales, had they begynnynge of suche small coniectures, with vncertaine hope (as it were preter spem sub spe) untill God and good happe, by the constant tranayle and balaunt minde of such as first attempted the same, gaue them to enioye that they hoped for. But what so euer they haue obteyned, and do enioy, this may I boldly say in your behalfe (right honorable and worshipfull) that there hath not lacked in you eether y<sup>e</sup> like or greater promptnesse of minde, so ward

## The Preface,

forwardnesse in attemptyng, magnificence in expences,  
and liberall in rewarde. For besyde the great charges  
and losses that you haue ben at otherwyle, what shoulde  
I speake of the great gyftes that you haue sente to the  
Emperour of Russia: What of your last chargeable vy-  
age of discoverye among the innumerable Rocks, I-  
landes, and mouzable mountaynes of Ice in the frozen  
sea, by innumerable landes and Ilandes unknowen to  
the Antiques euen vnder and farre within and beyonde  
the circle Arctike, where they thought that no lyving cre-  
ature coulde draue breathe or lyue for extreeme colde:  
whereas neuerthelesse the same hath ben by you discou-  
ered, euen vnto the myghtie ryuer of Ob, that falleth  
into the Scythian Ocean, or Oceanus Hyperboreus, not  
farre from the mountaynes called Hyperborei, so named,  
because they are situate almost vnder the North pole, and  
thought therefore to be inaccessible. A vyage doubtlesse  
of suche difficultie, and in maner impossibilitie, that con-  
sidering the infinite daungers thereof (as I haue lear-  
ned by thinfozmation of Steuen a Burrough, that was  
then the cheefe Pilote of the same vyage) it maye seeme  
impossible that they shoulde euer haue escaped, except the  
myghtie hande of GOD, by the expert skilfulnesse of so  
excellent a Pilote, had deliuered them from those daun-  
gers. And although in dedde (as religion byndeth vs) it  
is conuenient in all thinges to geue all honour, glorye,  
and thanks to God, yet are we not thereby restrayned  
to be thankfull to such men, as by theyr arte, ingenious-  
nesse, traualle, and diligence, haue deserved both iuste  
commendation and large rewarde. And therefore refer-  
ryng the rewarde to you (ryght honorable and worthy  
full, to whom it apperteyneth) yf I should not here geue  
hym at the leaste suche commendation, as in my iudge-  
ment he hath well deserved, I myght seeme both to de-  
fraude hym of his worthy desertes, and also to forgette  
the frendshipp and good wyll I beare hym, onely for his  
vertues and excellencie in his profession. For certayne  
when I consider how indigent and destitute this Realme  
is

## The Preface.

Is of excellent and expert Pilottes, I can do no lesse of conscience, then, in respect of your owne commoditie, yea rather for the commoditie of the Queenes Maiestie and the whole Realme, to exhort you, & put you in remembraunce (although I may herein seeme to put the spurres to a running horse, as saith the Proverbe) so to regarde hym, and esteeme him, and his faythful, true, and painful seruice towards you, that he maye thereby be further encouraged, and not discouraged, eyther for lacke of maintenaunce, or other wyse by the insurious assaultes of such his enemies, as only his vertues and excellencie haue mooued to beare hym displeasure, as enuy doth euer folow vertue, as saith the Latin Proverbe, *Virtuti comes inuidia*. And howe true a sentence this is, is wel verified by the saying of a certayne Philosopher (whose name I do not remember) who hearyng one vainely reioyce that he had no enemies: answered, that that was a token he had done little good: Meanyng thereby (as dayly experience proueth) that yf he had excelled in any vertue, he coulde not haue lacked some enemies. And hauing here touched to speake of enuy, I remember that when I was a yong scholer, I haue read in the Poet Hesiodus of two kindes of enuy, where of the one is called *Inuidia*, and the other *Aemulatio*, whiche is moze tollerable then the fyrste, for that it is toynd with some vertue, and enuyeth that anye shoulde excell hym in anye excellent qualitie that he professeth. But forasmuch as this enuy of emulation proceedeth of some singuler vertue of them that are so maliced, they maye herein reioyce, that they shall euer haue a hundred frendes for one enemy: yea, and although they hadde none, yet is vertue a rewarde to it selfe, and to be embraced for it selfe onlye, as the Philosophers asseyne. What then shall we saye to suche, as forgettyng this rewarde of vertue, do not onely fauour, but rather hynder the preferment and mayntenaunce of suche experte men, moze esteemyng certayne Fryghermen that go a traueling for fishe in Catches, or Spongers, and Dradgies for Wyllers about the sandes, betwene the South furlande  
and

## The Preface.

and Wynterton nesse, and the sandes about Temmes mouth, then they do suche excellent Pilotes as are able without any Rutter or Carde of Nauigation, not onely to attempt long and farre vyages, but also to discover vnknoʷen landes and Ilandes, as haue donne of late yeres many excellent men, to the great honour and enrichyng of theyr Prince and countrey. But as touching Steuen a Borrough, the cheefe Pilote of your vyages of discovery, it may hereby wel appeare that he is neyther malicious nor eniuous of his arte and science, in that he desyrez the same, for the common profit, to be common to all men: and for the same intent was the first that moued certayne worshipful of your company, as Syr William Garryb, Maister William Pericke, Maister Blase Sanders, and Maister Edward Castle, to haue this worke translated into the Englishe tongue. Who of their owne good nature, sauouryng all vertuous studies and the professors of the same, dyd soone encline to his honest request herein: and therewith not only desyred me, but also with liberall rewarde enterpayned me, to take in hande the translation. Whiche beyng nowe finished as well as my pooze learnyng may persourme, I desyre your honours, and worshypes, to accept in as good parte as I haue ment herein to gratifie you, and do suche seruice as my abilitye may suffice. So we therfore this worke of the arte of Nauigation, beyng published in our vulgar tongue, you may be assured to haue moze store of skilfull Pilotes. Pilotes (I say) not Pilottes, Rulers, not Routers, but such as by their honest behauiour and conditions, loyned with arte and experiente, may do you honest and true seruice: Whiche is not to be looked for of suche as beyng destitute as well of the feare of God, as of all morall vertues, superabounde in all noxious vyces, accomptyng desperatnesse for boldnesse, rashnesse, for hardinesse, impudencie for stoutnesse, and crueltie for manhood. What other thyng (I saye) is to be looked for of suche, then of suche trees, such frutes, Et mali corui, malum ouum. But for as muche as these haue no place appoynted them in

## The Preface.

the bodie of our common wealth, whiche we haue here befoze compared to the members of the body of man: therefore are they no otherwyse to be esteemed, then as excrementes of the bodye, to whom nature hath appoynted no place in the same, but labourerth continuallye to cast them forth by diuers wayes, least by theyr synthynesse they should infect the other members, euen as the pynne of the shippe, yf it be not amoyded, is noyous to the shippe and all that are therein. But the wyse and honest pylote, fyrst haung befoze his eyes the feare of **G D**, and puttyng his cheefe trust in hym, shall secondarily truste to his arte and science, without any such bayne obseruations as the superstitious Horoscopers (Astrologiers I meane, and not Astronomers) are accustomed to vse in the elections of houres, tymes, and dayes, by constellationes and aspectes of the Starres and Planettes, as many sonde menne haue donne, thynkyng thereby to haue escaped suche daungers, as they haue thereby the rather fallen into, through contempt of arte and science, by foolyshe confidence in superstitious Astrologie: whiche for the vanitie and vncertaintie thereof, the ryght woorthy shipfull, and of singuler learnyng in all sciences, **W** Thomas Smyth, in my tyme the flour of the Vniuersitie of Cambridge, and sometime my Tutor, was accustomed to call *Ingeniosissimam arte mentiendi*, (that is) the most ingenious arte of lyeing. Omytting therefore the superstitious and phantastickall obseruations of the iudicialles of Astrologie, it shalbe better and more necessarye for all Pilotes that desyre to excell in theyr profession, to learne and obserue the principles of this booke, whereby they may haue suche knowledge of the Sphere, as maye instructe them the makynge and vse of diuers goodly Astronomicall instrumentes pertynyng to the arte of Nauigation, by knowledge of the moouynges of the Sunne and Moone in theyr Spheres, and the other Planettes and fixe Starres: thereby to attayne to the true knowledge of houres, tymes, and tydes, with the variation of the Compasse, and many other goodly naturall obser-

## The Preface.

observations of weathers, tempestes, and calmes, by certayne infallible signes and tokens of the same, very necessarie to be obserued, and this by the true principles of *Astronomie*, and not of *Astrologie*. And this is the true *Astronomie*, whereof the diuine Philosopher Plato hath wyttten so diuine a sentence, that I haue thought the same here woorthye to be alleaged, that by the auctoritie of so famous an aucthour, we maye knowe what is true *Astronomie*, with the vse and commoditie thereof. Wherefore in his booke entituled, *Timeus* vel *De Natura*, these are his wordes. *Rerum autem optimarum cognitionem, nobis oculi attulerunt. Nam hæc quæ de mundo disputantur, nunquam inuenta fuissent, si neque sydera, neque sol, neque Coelum, suspici potuissēt. Cognitione vero diei ac noctis, ab oculis orta, fecit vt dimensione quadam, mensium annorumque ambitus metiremur, tempus cognosceremus, ac vniuersæ naturæ ordinem scrutaremur. Quibus ex rebus, philosophiam adepti sumus.*

What is to say, Our eyes haue brought vnto vs the knowledge of most excellent thynges. For what so euer is disputed of the worlde, had neuer benne inuented, yf neyther the Starres, neyther the Sunne, neither heauen, coulde haue benne seene. For the knowledge of the daye and nyght, taking begynnynge at the eyes, caused vs, as it were by certayne limittes and boundes, to measure the circuittes of monethes and yeeres, whereby we came to the knowledge of tymes, and the order of vniuersall nature. And hereby also we obteyned the knowledge of Philosophie. &c. And thus by the auctoritie of diuine Plato, (whom for his excellencie, Cicero called *Deum philosophorum* (that is, the God of Philosophers) we maye vnderstande, that the true *Astronomie*, is the perfect knowledge of the miraculous mouinges of the planettes, Starres, and heauens (and especiall ye of the Sunne and Moone) whereby is caused the varietie of tymes, and diuersitie of all naturall thynges, by naturall causes: as by the qualitties of Elementes, as hotte, colde, moyste, and drye, whiche are augmented or diminished by the

## The Preface.

more or lesse influence of these two Luminaries, as they comie nearer vnto vs at sometymes, or departe further from vs at other tymes, with diuers motions in diuers climates, whiche causeth not onely varietie of tymes in sundry climates, but also the varietie of diuers complexions, fourmes, and dispositions of all creatures vnder the face of heauen, none other accidentall contyngent, voluntarie, or violent cause, to the contrarie notwithstanding. And this is it that Plato meaneth by those wordes. *Vt tempus cognosceremus ac vniuersæ naturæ ordinem.* &c. That is, to knowe the tymes and vniuersall order of nature. And doubtlesse, who so well consydereth the maruaylous effectes that are caused, especially by the variable moouing of the Sunne in the Zodiac, muste needs acknowledge it to be the cheefe instrumente & meane that God vseth in the generation, preservation, and alteration of all creatures that are conteyned in the worlde, of generation and corruption. And for this consyderation, certaine of the ancient Philosophers called it the soule of the worlde: Other, the eye, and other also, the heart of the worlde. Plato also affirmeth, that the soule of the worlde is in the Sunne: And that all other lyving thynges, receiue lyfe from thence. And hereof commeth the saying of the Philosopher, *Sol & homo, generant hominem*: (that is) the Sunne and man, begette man. And therfore (as wyrteth Marcilius Ficinus) of all idolatres they are moste tollerable that honour the Sunne for God. The which, although it be not, yet vndoubtedly are his effectes so great and woonderfull in this inferiour worlde, that it maye seeme in manner to be Gods Vicegerent, Lieutenant, and Viceroy in al the woordes of nature, except where and when it pleaseth him in any thing miraculously, other wyse then by the common order and course of nature, to commaunde the contrary.

And yf it may not be tedious vnto you (ryght honorable and worshipfull) it shalbe a pleasure vnto me, for the better declaration hereof, to make a brieue discourse of the marueylous and straunge effectes that are caused by the  
Sunne:

## The Preface.

Sunne: whiche perhappes fewe haue donne, other wyse then dispersedly here and there, as occasion hath serued. For the therefore let vs consider what it hath donne ouer the Equinoctiall lyne, and vnder both the Poles at one instant, yet dyuersly and contrarily the one to the other. For so hath the infinite wysedome of the greates God of nature, the supream Architecture of the vniuersall worlde, disposed all thynges in suche perfecte order, that to them that are vnder the Equinoctiall, and haue theyr Horizon passing by the two Poles, the daye is of .xij. houres, and the nyght as muche, and theyr yeere also is diuided into .xij. monethes: But they that dwell iuste and perpendicularly vnder our Pole, and that haue theyr Horizon passing ouer the sayde lyne, haue the daye of syre monethes: That is to say, begynnyng from the tenth daye of Marche, when the Sunne commeth ouer the sayde Horizon, vntill it returne to pass vnder the same at the tenth of September. And contrary wyse, one night of syre monethes haue the inhabitauntes vnder the Pole Antartyke: whose yeere, (that is to saye, all the course that the Sunne maketh by the .xij. signes of the Zodiac) is accomplished in one day and one nyght. A thyng doubtlesse moste woonderfull and marueylous. Lyke wyse, when we haue Sommer, they that are vnder our Pole, haue the day of syre monethes, and they of the opposite or contrarie Pole, haue theyr nyght of the same length. Agayne, when it is wynter with vs, then vnder our Pole is the nyght of the sayde syre monethes: and vnder the opposite Pole, is the day of the same length. So that, as it were, course by course, when we haue the nyght, they haue the day: And contrary wyse, when we haue the day, they haue the nyght. The which, although it be so long, and of so greatespace of tyme, yet is it not continually obscured with darkenesse. For the Sunne maketh his course in suche order, that the inhabitauntes of that parte, lyue not during that tyme altogether in darkenesse, as Poles lyue vnder the grounde, but as other creatures that lyue vpon the globe and face of the earth,

## The pface.

earth, they haue suche lyght as maye suffice to susteyne  
and maynteyne theyr lyfe . For the bodye of the Sunne  
declyneth no more eyther beneath the Equinoctiall lyne,  
eyther aboue the same lyne (which is the Horizon to both  
the Poles) then 23. degrees : that is to saye, no lower  
or hygher then the Tropikes , whiche are no more then  
23. degrees , or there about , from the sayde Equinoctiall  
that is the Horizon , as is aforesayde . And yet in these  
23. degrees , he maketh not his course by the opposite Di-  
ameter, but goeth continually rounde about in circuste :  
so that his beames reuerberatynge heauen , repesente  
suche a manner of light, as we haue in Sommer, two  
houres befoze the Sunne ryse . And this example whiche  
we haue taken of the diuersitie of the Horizons of the  
Equinoctiall, and vnder the two Poles, is to demon-  
strate the marueylous effecte that the Sunne maketh,  
departyng from the .xj. houres of the Equinoctiall (that  
is to saye, from Aries, to Libra) and comyng by lyttle  
and lyttle, illuminatynge the Globe of the earth, and so  
reducing the yeere of .xj. monethes , into one onely day,  
and one nyght, as is sayde befoze. Vnder the infinite  
varietie of the which course, sometyme with long dayes,  
and sometyme with shorte, all the Inhabitauntes of the  
woylde are fourmed and disposed, of suche complexion  
and strength of bodye, that euerye of them are proportio-  
nate to the Climate assigned vnto them, be it hotte or  
colde, and may dwel and abyde there, as in theyr natural  
place, and temperament, not lamentynge, or despyng to  
dwell elswhere, so greates a loue reasteth in them to theyr  
native situation . But not to departe from the vyage  
whiche the Sunne maketh in one whole yeere, as some-  
tyme appocheyng neare vnto vs, and sometyme depa-  
rtynge from vs, I saye, that at one selfe same tyme, in dy-  
uers partes vppon the rounde Globe of the earth, it cau-  
seth the Sprynge, Sommer, Autumne, and Wynter.  
And neuerthelesse, at the same instant and punct of tyme,  
it maketh day and bygh noone in one place, and night and  
mydnyght on the opposite parte. The whiche varietie, al-  
though

## The Preface.

Though it appeare incomprehensible to the slenderesse of our wittes, yet beholding the same with the eyes of vnderstandyng, and therewith consyderyng the vnestimable mouing that the Sunne maketh continually, we shal finde it to be true, hauing respect to the diuers situations of the earth, as it is continually illuminate moze or lesse by the Sunne. And this varietie is made with such a Harmonie and consonancie, and suche a lawe perpetuall and immutable, that if any poynt or pteke therof shoulde fayle, it is to be doubted least the elementes shoulde be confounded togeather, and returne to their fyrst Chaos.

And to haue sayd thus much of the wonderfull effectes of the course of the Sunne, it may suffice for an example to proue how necessary a thing it is, not only for all Pilotes & Sea men to haue the knowledge hereof, but also for all other such as shal attempt great & farre vyages in vnknowen landes and straunge countreys, as dyd of late Master Jenkynson, a worthy gentleman, set forth by you, & mainteyned at your charges, moze lyke an Ambassadour sent from any Prince or Emperour, then from a compaignie of marchant men. Wherein, what commendation you haue deserued, to the encrease of your perpetual fame & honour, I referre it to that I haue sayde before. And as touchyng master Jenkynson, what trauayles, paines, & dangers he hath susteyned, & hardely escaped, and what diligence and arte he hath vsed in the seachyng of straunge countreys, and in the discription of those his vyages, it were but in vayne for me to wyte muche vnto you, vnto whom the same is better knowen then to me. And therefore to conclude, with rendyng iust comendations both vnto you & him, I can say no more, but as Plato writeth in his booke De Legibus, Decens est eos ciues laudibus ornare, qui corporis vel animi viribus, res arduas preclarasque gesserunt, & legibus libenter paruerunt. That is to say: It is decent to commend those Citizens, that by theyr industrie of bodye or mynde, haue donne great assayes, and haue willingly obeyed good lawes.

And

## The Preface.

And thus chesones desyring your Honours and Whoo-  
shyppes, to accept in good parte whatsoeuer I haue sayd  
of good wyll and affection towarde you and your pro-  
ceedynges, and with your sheelde of Justice and  
auctozittie, to defende me agaynst the assaultes  
of suche as are enemies to vertue, and  
captious of other mens doynges:

I rest at your commaunde-  
ment to the vttermoſte  
of my power, to do  
you what seruice

I maye.

(.:)

# The Epistle Dedicatorie of Martin

Cortes, to the most mightie and victorious  
Monarch Charles the Emperour, the first  
of that name, King  
of Spaine.



So greatlpe were esteemed the inuen-  
tions of certayne artes and sciences in  
auncient tyme (as wryteth Saint Au-  
gustin in his bookes De ciuitate Dei) The first in-  
uentours of  
artes.  
that they tooke them not for mortall  
men, but honoured them as immortal  
Gods. His arryuing in Egypt, orde-  
ned common weales with iuste gouernaunce, gaue them  
lawes, and knowledge of letters, and taught them also  
the vse of Flare. In consideration whereof, she was  
honoured of suche as then knewe her, and reuerenced of  
them that came after her: In so muche, that they establi-  
shed a capitall penaltie or punishment of death, against  
all suche as eyther in spoote or in earnest affyrmed her to  
be an earthly woman, and not rather a diuine Goddesse.  
Ceres beyng of lyuely wytte and cleare vnderstandyng, Ceres.  
beholdyng in the Cicilians humane similitude, and  
shape to the outwarde apparence, and inwardlpe the  
fiercenesse of brute beastes: bydeled theyr customes,  
and resourmed them with newe statutes, teachyng them  
to tame Oren so beare the yoke, to sowe Wheate for  
theyr great commoditie, to Brynde in the Wyll, to  
Dance in the house, and to baie in the Ouen. In re-  
compence whereof, they made sacrifice vnto her, and  
buiilded many sumptuous temples in honour of her. Sa-  
turnus comyng from Crete, gaue lawes vnto the Latines, The Cicilia-  
ans.  
whereby they myght gouerne them selues, and prescribed  
them maners of liuyng, teachyng them to Wyll and Pa-  
nure the grounde, and sowe Corne, and to geather rype the grounde.  
fruytes in due season. And yf Saturne were profitable  
to those nations, and they not vnthankfull vnto hym,  
in that they buiilded hym Altars, celebrated vnto hym  
festiuall dayes, and accounted hym in the number of

## The Epistle.

**The golden  
world & reign  
of Saturne.**

**The worthy  
factes of  
Charles the  
fyste.  
Sicilia,**

**Spayne re-  
formed.**

**The trium-  
phes and vic-  
tores of  
Charles the  
fyste.**

the heavenly Goddes, naming hym also the father of the Goddes. And if (I say) he was to them so profitable, and that world iudged so happy and prosperous for hauing so valiant a kyng, & so fast a law geuer, that it was therfore by the mouthes of all men called the golden worlde, and raigne of Saturne. Certesse, except I greatly deceaue my selfe, this our tyme is nothyng inferiour to that. For we know certainly that your Maiestie hath ben more profitable to Spaine, then ever was Saturn to the Latines: and also a more excellent law geuer, in manner to al Europe, and further, to the newe world lately discovered, then he that gaue lawes but only to a litle corner of Italy. Whereby I consyder, that the felicitie of your Maiesties tyme, hath ben no lyttle commendation to your doynge, in that you haue banished vice, honoured vertue, punished offenders, and fauoured innocentes: so that the quiet haue thereby lyued more peaceably, the vniquiet restrayned, the good exalted, and the euyl chastised: In so much that now, by reason of iust ministracion of good order in your Maiesties dominions, they that walke in the nyght go in safetie, wheras we know, that in other prouinces, such as walke in the day go in daunger & perill. And therfore in the most happy tyme of your Maiestie, it appeareth that Spaine is renewed, not onely in the excellencie of mechanycall or handy craftes, but also in the knowledge of letters and discipline of warre: In so muche, that she that somtyme lacked her selfe, may now aboundantly minister to her neyghbours that haue needs. And whereas to your Imperiall Maiestie, it shoulde not suffice to ordeyne lawes, yf power and armes should faile to defende and punish: who, comparable to your Maiestie, enioyeth the one, and wanteth not the other, hauing triumphed ouer kynges and kyngdomes, enlargyng also the name of Spayne in many vnknown and barbarous landes and nationes: Greater duetie therfore owe your subiectes vnto you, then ever dyd the Egyptians to Isis, or the Cicilians to Ceres, or the Latines to Saturne, soasmuch as they haue receaued of your Maiestie more common and profitable benefites. It is not long since your Maiestie hath so-

bidden

bydden and abolyshed the vse of Pulcs, and restored a *Quila*,  
 gayne the exercise of armes, so long out of vse, that the  
 one with the other, hath ben no smale profits and com-  
 moditie to your subjects and dominions. For by taking *horses and*  
 alwaye the vse of Pulcs, is so increased the number of *horsemenne.*  
 hoxses and hoxsmen, that such as befoze neyther durst  
 nor could in maner light by vpon a hoxse, can now easly  
 & aptly manege them. So that you seeme to haue reatued  
 the dayes of Bellerophon the sonne of kyng Glaucus, and *Bellerophon.*  
 lykwyse the tyme of Saturne, when men had firste the  
 knowledge howe to make hoxses to abyde the byddle, and  
 to bring them by to serue for dyuers vses and necessyties  
 of men. And ryght sure I am, that by reason of suche  
 laudable statutes and ordynaunces in your dominions;  
 shall sayle neyther hoxses, nor horsemen, as well for the  
 courte, as for the campe. *Who knew in manner howe to*  
 gyrd a sword, befoze that your maiestie permitted weapons  
 and armure to be wyorne, euen in your courte, and that  
 els where, al men myght do the lyke: befoze which tyme  
 dexteritie sayled, where courage abounded. Duer and  
 besyde the profite and commoditie that hath rylen hereof,  
 what honour you haue obteyned by the same, is manifest  
 by *Fraunces the frenche kyng,* who by your maiestie  
 being taken prysoner in the parke of Pauia, was brought  
 to Madrid, in the yere. 1525. where seeyng many young  
 men in maner without beardes, and yet laden with ar-  
 mure and wyapons, sayde: O happye Spayne, that  
 byngest forth and nourishest menne of warre. In your  
 moste happye dayes also, the Christian sayth is amplified,  
 and in maner whole Spayne flourisheth dayly more and  
 more in sumptuous buildyngs, & is abundantly enriched  
 in treasure brought from your Indies, farre surmounting  
 the riches of Salomon, brought from Ophir. Pea & to say  
 the trueth, considering the haules of gold & siluer, which  
 haue benne ordinarly brought from thence to your mai-  
 estie, this tyme may rather be called a golden age, then that  
 of Saturne. Not omitting also, that by your prosperous  
 attemptes, haue ben discovered so many landes & Ilands,  
 heretofore so vnknown to the *Cosmographers, Geogra-*  
 phers,

*wearing of  
 weapons, and  
 armour.*

*Fraunces the  
 French kyng  
 taken prysoner*

*The Christi-  
 an sayth en-  
 larged.*

*The sumptu-  
 ous buildyngs  
 and riches of  
 Spayne.*

*The Indies  
 nautes of gold  
 and siluer.*

*Newe landes  
 and Ilands  
 discovered.*

## The Epistle.

Peru.  
The straigh-  
tes of Maga-  
llanes.  
Rio de la  
plata.  
Thefortunate  
Ilandes, or  
Canaries.

Religion in  
the Indies.

The Spany-  
ardes haue  
euer traualled  
into farre coun-  
treys.

The antiqui-  
tie of Naui-  
gation.  
Argonanti.  
Colchos.

The arte of  
Nauigation.  
Chinges par-  
tenning to  
Nauigation.

phers, & Historiographers, that they neuer heard of theyr  
names. Whiche neuerthelesse are now so well known to  
your subiectes, that they haue troden them with their fete,  
and measured them by pases. Who befoze this time euer  
hearde anye mention of the riche and large Prouince of  
Peru, or of the straighytes of Magallanes, or of the ryuer of  
Syluer, called Rio de la Plata. They in tyme past seemed  
to haue donne no smale thyng, when they had knowledge  
of the fortunate Ilandes, the whiche, since they were con-  
quered by your Maiesties graundfather, haue benne called  
the Ilandes of Canaria. And yf it be, and hath benne much  
to discouer and subdue this newe worlde: it is doubtlesse  
no lesse glorie to your Maiestie, not onely to possesse and  
enioye it, but also that you daylye procure to sende thither  
Iudges to gouerne with lawes, and preachers to instructe  
in doctrine, to byng those Indians to the knowledge and  
honouring of the true God. And therefore consydering  
your Maiesties godlye desyre and purpose, as touchyng  
these Nauigations, and the dangers of suche as goe to dis-  
couer this new worlde (although it be not new to the Spa-  
nyardes to traualle into farre countreys, for as muche as  
in the dayes of Caius Cesar, the sonne of Augustus, were  
founde broken peeces of Spanyshe Shyppes, losse in the  
goulfe of Arabie, as also, Celius Antipater affirmeth, that  
certayne Shyppes of Spayne were accustomed to sayle for  
Marchaundise to the East partes of Ethiope) in consydera-  
tion hereof, haue I the more wyllyngly published these  
my traualles, for the furtheraunce of all suche as shall  
hereafter attempte the lyke Nauigations. And here doo  
I not saye that Nauigation is not a thyng of antiquitie.  
For we reade that in olde tyme the Argonanti sayled to  
Colchos, and Danaus brought the firste Shippe from E-  
gypte to Grece. But I saye, that I am the fyrste that  
haue brought the arte of Nauigation into a breefe com-  
pendiousnesse, geuyng insayleable principles, and euident  
demonstrations, describyng the practyse and speculation  
of the same, geuyng also true rules to Mariners, and  
shewyng wayes to Pilotes, by teachyng them the ma-  
kyng and vse of instrumentes, to knowe and take the al-  
titude

titude of the Sunne, to knowe the tydes of ebbing and  
 flowing of the sea, howe to order their cardes and com-  
 passes for Panigations, geuyng them instructions of the  
 course of the Sunne, and motions of the Moone: teaching  
 them furthermoze the making of Dyalles, both for the  
 day and for the nyght, so certayne, that in al places they  
 shall shewe the true houres without defaute: and haue  
 lyke wyle declared the secreete propertie of the lode stone,  
 with the maner and causes of the Northeastynge & North-  
 westynge (commonly called the variation of the compasse)  
 with also instrumentes thereunto belongynge. And that,  
 that whiche I shall saye or do, be not accompted to be  
 presumptuouslye done or spoken, I acknowledge that  
 whatsoeuer I haue well done or wrytten, it is from a-  
 boue by the helpe of the diuine grace, and by the fauoure  
 and prosperous fortune of your Maiestie. And thus shall  
 they that nowe lyue, and lyke wyle they that shall succede  
 vs, see and perceaue, howe much moze the worlde oweth  
 and is beholding to your Maiestie, then were the aunci-  
 ent Egyptians to their Isis. She gaue them letters to  
 reade, but your Maiestie hath geuen rules and orders to  
 sayle on the seas. The profite of Isis, was onely for one  
 prouince. But the commoditie that ensueth of your do-  
 ynges, is vniuersall for all prouinces and nations, and  
 for all seas, as well to go to places discovered, as also to  
 discover landes and regions yet vnknownen. If they of  
 auncient tyme had reached that we haue obteyned, the  
 Indies had not nowe bene to discover: neyther should it  
 be esteemed a myracle vnto vs, as at the tyme when Car-  
 thage floished, that one Agnus went forth from the  
 baye of Cadiz, and sayled to the ende of Arabie. Neyther  
 woulde Cornelius Nepos haue wrytten it for so famous a  
 thyng, that a certayne man flyng from King Latinus,  
 came from the goulfe of Arabie: whereby it is manifest,  
 that as well Panigation, as other artes, both from daye  
 to daye increase, and by lytle and lytle is come to perfec-  
 tion. For in those dayes they had neyther compasse nor  
 carde of sayling whereby to gouerne them selues. They  
 lacked the consideration of the starres, vntill the Phen-

The lode  
 stone, falsly  
 called in Eng-  
 lish the Adamant,  
 is in Latin  
 called  
 Magnes.

Charles the  
 first greater  
 then the He-  
 roes of olde  
 tyme.

Vniuersall be-  
 nefytes.

Comparison  
 with the an-  
 tiques.

Plinie.

Panigations  
 of olde tyme.

The perfecti-  
 ons of artes at  
 this day.

## The Epistle.

**The rudeness  
of the anti-  
ques.**

**Augurium.**

**The North  
Starre.  
The byages  
of Salomon  
to Tharsis,  
and Ophir.**

**The fyist in-  
uentours of  
Navigation.**

**Commodities  
and difficul-  
ties of Navi-  
gation.**

tians founde the knowledge thereof, and were the fyrste that vnderstoode (that to suche as shoulde trauaile by sea) it shoulde be necessarie to lyft by theyr eyes to heauen, and consyder the motions thereof. They that sayled to the Ilande of Taprobana (which in olde tyme was called Antitono) carped for their byages luyng byrdes. And when they thought good, let certayne of them flee: and by the flyght of their wynges, directed the helme and sayles of theyr shippes. They sayled onely thre monethes in the yeere. So them therefore it was necessary to obserue and tarye the tyme, vntyll they founde it to serue with a forewynde. They knewe not howe to helpe them selues with the bolwe line, or syde wynde: neyther sawe they the North starre, or sought it, or hadde any knowledge thereof. And I beleue verely that this was the cause of so long a byage whiche the shippes of Salomon made, sayling to Tharsis and Ophir, wherein they spent thre yeeres: although in deede that was no short byage which they made, compassyng about India, and many other prouinces. And whereas before I sayd, that Navigation by lyttle and lyttle came to perfection, I fynde by auncient hystories, that Typho fyist founde the Couernal, or Rudder, Dedalus the Maste and Shrotdres, and Icarus the Sayles, the Thirreni founde the vse of the Anker of one graspe or flooke, & Palaminus brought it to perfection, addyng the other. And thus may it manifestly appeare, that in these prosperous and fortunate dayes of your Maiestie, it hath pleased God to byng the knowledge of Navigation to perfection, with this my breefe discourse as touchyng the same, as well profitable and necessary for them that trauaile by lande, as by sea. What can be a better or more charitable deede, then to byng them into the waye, that wander? What can be more difficult, then to guyde a shyppe engoulfed, where only water and heauen may be scene. One of the foure most difficult thynges, wherof Salomon maketh mention in his Proverbes, is the byage of a shyppe by the sea. The which Galfrede expoundyng, sayth, that in humane thynges, none is more fearefull or more dangerous, then

then to aduenture life in a weake and thinne peece of wood,  
 or for a man to commit him selfe to the rage of furious win-  
 des, among the tempestes of the sea, and there to harsarde  
 that he loueth so well. How muche moze should the same  
 seeme difficult to Salomou, yf at these dayes he shoulde  
 see that fewe or none of the Pilotes can scarsely reade, and  
 are scarsely of capacitie to learne. And whereas in the firste  
 Chapter of this booke, I haue made mention, that the go-  
 uernall or sterage, ought to be committed to expert menne,  
 and of good vnderstandyng, he shoulde see, that nowe a  
 dayes, the ignorant presume to gouerne other, which were  
 neuer able to rule or gouerne them selues. I moske humblye  
 desyre your maiestie, to receaue in good part this my pooze  
 service: whiche, although it be litle, yet being dedicate vnto  
 the greatnesse of your Regall person, it shalbe muche  
 moze then greate. The profite and commoditie therof, is no-  
 toxiuous, and the benefite that thereby maye be receaued, is  
 vniuersall. If therefore, when your maiestie shall finde your  
 selfe released from greater affayres, it maye please you  
 to feede your eyes with these my trauayles, you shall  
 finde therein many newe, delectable, and twitty thin-  
 ges, with also many profitable and certayne rules,  
 both to reade and vnderstande. To con-  
 clude, I eftsoones make humble pe-  
 titions to your Imperial Ma-  
 iestie, not so muche to  
 consider what I  
 wyte,  
 as to respecte the intent of my wytyng: and  
 not the gyfte, but the affection and  
 good wyll that remaineth  
 in me to serue your  
 Maiestie.

The igno-  
 rance of Pil-  
 lottes.

The gouernall

The first parte of this woorke, whiche  
entreateth of the composition of the  
woylde, and of the vniuersall  
principles for the art of Pa-  
uigation.

The firste Chapter, of the general distinction  
of creatures.

Three diffe-  
rences of crea-  
tures.

Corpozall cre-  
tures.

Man is called  
all creatures,  
and the lesse  
woylde.

Man compa-  
red to the  
woylde.

All that moou-  
eth, is moou-  
ed by an o-  
ther immoue-  
able.

The intellec-  
tine soule.



**I**nfinite God, the beginning  
and cause of the whole vniuersal,  
created three orders of creatures,  
differing in kynde: that is to say,  
corpozall, as the Elementes:  
spirituall, as angelles: and com-  
pounded of these two, as man.  
The corpozall nature, is diuided  
into bright and shynnyng bodies,  
as the starres: or into darke and thicke bodies, as earth  
and metals: eyther into Diaphane or transparent bodies,  
as ayre and water. Of these creatures (as sayth. S. Grego-  
rie) some haue onely being, as stones, some lyue, as trees, &  
other haue sense, as beastes, other, vnderstandyng, as man:  
who in hollye scripture is called all creatures, accordyng to  
the saying of Christe to his disciples, where he sayth, Goe  
and preache the Gospell to all creatures. And therefore not  
without good cause was man called of the Greke Philoso-  
phers, Microcosmos, (that is) the lesse woylde. In the which  
we contemplate thynges of no lesse admiration, then in the  
great woylde. The similitude betwene them both, is, that  
euen as the great woylde, & the whole globe or sphere therof,  
is mooued by the voluntarie motion of an intellectuall sub-  
stance, or an angell: euen so is this. For (as Aristotle wy-  
teth) what so euer is mooued, is mooued by vertue of an o-  
ther: as man is mooued by the internal or inward soule  
that is within him, (that is to say) by the intellectuall soule  
that is proper vnto hym. In lyke manner, in the greates  
woylde are founde dyuers moouable thynges: All whiche  
are reduced to one immoueable moouer. So in man are  
founde many thynges mooued by diuers motions, whiche  
are

are all referred to his intellectuall soule. The great worlde conteyneth the creatures within it selfe, and consequently is all really, as hauing nothing without it. Euen so, man by knowledge is all, and knoweth al thynges, and nothing naturally is hyd from hym, or vnknoyn to hym. Againe, in this lesse humane worlde, are two motions, intellectuall, and sensuall. Then consequently the great worlde hath two local motions. The one, wherewith the first moouable is mooued, and dyaweth with it al the other spheres, from the East to the West, and is called Rationall moouyng. The second, is the moouyng of the other spheres, from the West into the East: and is called Irrational moouyng. But now leauing to speake of the lesse worlde, we will proceede to speake further of the greater.

Man knoweth part of al thynges.

Two motions in man.

Primum mobile.

Rational motion.

Irrational motion.

### The seconde Chapter, of the definition of the worlde.



**W**HE worlde (as sayth Iſodorus) is heauen and earth, and the other woorkes of God, that are conteyned therein. It is compounded of thynges visible, and yet vnsearchable. Poyles and Saint Iohn the Euangelist witnesseth, that it was made by God. The

what is the worlde.

Philosophers called it Mundus a mouendo, because it is in continuall moouyng, and neuer in rest. The Grekes called it Cosmos, whiche signifieth, saye or beautifull, and so named it, because of the marueylous ornamēt thereof, and diuersitie of Clementes, with the resplendence or shynyng of the Sunne, Moone, and Starres. And doubtlesse, nothyng maye be scene with the corporall eyes of man, more beautifull then it is. In so muche that the diuine Philosopher Plato affirmed, that eyes were geuen to men to beholde the beautie thereof, and to take pleasure in the contemplation of the heauenlye bodies, and roundnesse of the world, which also for the roundnesse thereof, is called spherical, because that Sphera in the Greke tongue, signifieth a rounde body.

Or Mundus a Munditie. That is, clearnesse, or saynesse.

Eyes were geuen to men to beholde the fauencess, and beautie of the worlde.

The roundnesse or the worlde.

## The first parte.

### ¶ The thirde Chapter, of the definition of the Sphere.

Definition of  
the Sphere.

The center of  
th. Sphere.



Proclus sayth, that the Sphere is a whole and corporall figure, vnder one superficiall: in the myddest whereof, is a poynt or pricke, from the whiche all ryght lynes drawen directlie to the circumference, are equall.

This poynt or pricke, is called the center of the Sphere. Accor-

dyng to Euclide, it is the passage of the circumference of halfe a circle, whiche is turned rounde about his Diameter that is fixed, vntyll it returne to his owne proper place agayne, as where it was at the firste. By the center of the Sphere, passeth a ryght lyne, and thertremities or endes thereof, touche in the circumference. And this lyne (imagined) is called the Axis, or Crestree of the Sphere, & the endes thereof are called the Poles. Upon this Axis, is the Sphere of the worlde mooued.

The Axis and  
Poles of the  
worlde.

### ¶ The fourth Chapter, of the diuision of the worlde.

Quinta es-  
sencia,  
Aristotle cal-  
leth it the. v.  
Element.



It is to be presupposed, that there is difference betweene element, & elementate, & the fifth, being called Quinta Essencia. The quint essence, or fyfth substance, is a body of it selfe, differing from al elementes, and thynges elementall, as wel in matter, as in forme, and no lesse in nature and vertue: and

The. v. es-  
sence is incor-  
ruptible.  
What is Ele-  
ment.

The inferior  
Elementes  
are not pure  
nor simple.

hauyng in it selfe no contrarietie, is certainly without corrupcion. And hercof commeth it, that the Philosophers called the heauens and heavenly bodies, the fyfth substance, or fyfth essence, by reason of the incorruptibilitie thereof. Element is that, whereof any thyng is compounded. It is the firste of compositions: and of it selfe is not compounded. Whereby it foloweth, that neyther the earth, the ayre, the water,

## The first part.

Water, nor the fyre, that are neare vnto vs, or about vs, are pure or simple elementes. For these elementes doo sometymes myngle them selues one with another, and especially where they are neare togethether, and touch one another. Of these elementes euery part is named by the name of the whole: As euery part of fyre, is called fyre, and euery part of earth, is called earth, and so of the other.

They are called simple bodyes, in respect of other compoynde and mixt bodyes. They are diuisible into partes of dyuers fourmes: and of the commixtion of them, are made and engendred dyuers thynges of sundry kyndes.

These foure (that is to meane, earth, ayre, water, and fyre) although they are named simple, but in respect as aforesayde, yet are they the elementes (that is to say) begynnynges and principles of al other compoyndes & mixtes.

A pure element can not be seene, sozasmuch as that that is pure, lacketh colour: & that that hath no colour, is not visible. The elementes (as sayth Isodorus) were diuided by the hand of God. The Imperial beauen was replenished with Angels, the ayre with byrdes, the sea with fshes,

and the land with men, and other beastes. Elementate, is euery body compoyned of the foure elementes. Not that they are elementes formallye, but virtually in mixt bodyes. This knowen, we wyll shewe howe the worlde is diuided into two regions: Celestiall, and Elementall. The region Elementall, which is continually subiect to alterations, is diuided into foure elementes: which are, earth, water, ayre, and fyre. These elementes, the Greekes call Yctogia, for the communion and concozde that they haue betwene them selues. The heauenly or etherial region (called Quinta Essentia) compasseth and conteyneth the elementall worlde within it.

The elementes are diuisible into partes.

The commixtion of elementes.

Pure and simple elementes can not be seene.

The diuision of elementes.

What is Elementate.

Diuision of the worlde into Celestiall, and Elementall.

Quinta Essentia.

✱ The .v. Chapter, of the number, order,  
and propertie of the Elementes  
and Heauens.

The

## The first part.

The order of  
Elementes.

Earth.

Water.

Ayre.

Fire.

The fourme  
of the water.



The earth (after the Philosopher) is a  
prikke or poynnt in the myddest, called  
the center, to the whiche they assigne  
the lowest place. Next vnto the earth,  
and about it, the water occupieth the  
seconde place, and the ayre the third.  
The fyre is hygher then any of the o-  
ther elementes. And it is to vnder-

stand, that the water hath two superficieses. One, which  
is called concave or hollowe. The other, conuer or em-  
bowyng. You maye compare the inwarde parte of the  
concave to a dyshe or a bolle, whose outwarde parte is  
called conuer. As touchyng the concave, the water com-  
passeth about the earth, leauyng discovered that parte  
that serueth for the respiration and lyfe of men, and o-  
ther beastes. As concernyng whiche, sonne thynke that  
the Ocean sea is hygher then the earth: and aske the  
question why the sea couereth not the whole earth, and  
why the earth is not sonke in the water. To this it maye  
be a sufficient aunswere, that it hath so pleased the wyll  
of God, acco;dyng to the saying of the Prophete Dauid:  
Terminu posuisti quem non transgreditur: Neque con-  
uertetur operire terram. That is: Thou hast appoynted  
limittes, which it shal not passe, neyther shall it returne  
to couer the earth. Besyde, the wyll of God, whiche is  
the cheefe and sufficient cause thereof, we say that nature  
sayleth not in her necessities. For the somtyme ad-  
mitteth a little inconuenience, to auoide a greater euyl:  
as when heauy thynges, which naturally shoulde descende,  
do not onely not descende, but ryle vp: And as also some-  
tymes it chaunceth that fyre descendeth, and water ar-  
ryseth to fyll the voyde or emptie place, leasse anye where  
shoulde be founde voyde or emptie, whiche nature so great-  
ly abhorreth. To this purpose, nature foreseeyng the  
kyndes of many thynges that coulde not els where lyue  
then on the earth, neyther be conserued within the wa-  
ter (as men, and other earthly beastes) determined be-  
fore to make the earth not perfectly rounde, contrarye to  
the nature thereof: whercof it foloweth, that it is not al-  
together

The Ocean  
sea.

psal. cvii.  
Job. xxxviii.  
The wyll of  
God, is the  
cause of causes

Nature ab-  
horreth emp-  
tines.

The earth is  
not perfectly  
rounde.

fogether covered of the water. And as (sayth Oxygen) the earth remaineth discovered of water, that it myght byng forth frutes, trees, and plantes. As touchyng the conuer aforesayde, the water and earth discovered, are conteyned vnder the concavittie of the ayre, whiche is diuided into thre Regions, as the lowest, hyghest, and myddlemoste. The lowest is hot, by reason of the reflection or rebounding of the beames of the Sunne, strycken backe by the earth. The hyghest also is hot, by participation of the fyre, and nearenesse thereunto. The myddle region is colde, as is manifest by the snowe and hayle, engendered in the same. The ayre neare vnto the Region of the fyre, whiche is pure heate, dooth neyther burne nor lyghten, because it hath no combustible matter, and so hath it power, and not acte. It is neare vnto, and reacheth the circle of the Moone, whiche compasseth it about. The heauen, or circle of the Moone, is next vnto the heauen of Mercurie: And Mercurie vnto Venus: Venus vnto the Sunne: The Sunne, to Mars: Mars to Jupiter: Jupiter to Saturne, whiche is next, and reacheth vnto the heauen of the Starres, called the firmament, because that in it are all the starres (excepte the planettes) firme and fixt as a knotte in a table. The knowledge of the planets was had by seven sundry motions they haue among them selues, and by theyr course, not vniforme to that of the starres of the eyght heauen, because that sometimes the planettes appeare vnto vs ioyned together, and sometimes diuided. The Crystalline heauen compasseth about, or conteyneth within it, the heauen of starres. This Crystalline heauen, is transparent, & perspicuous, as cleare water or glasse that maye be seene through, by reason of the clearenesse and pure substance thereof. It is by another name called, the heauen of water, whereof holye scripture speaketh, saying: Aquæ quæ supra cælos sunt, laudent nomen Domini. That is to say: Let the waters that are aboue the heauens, prayse the name of the Lord. It was created for the conseruation of corporall thynges, and to temper the heate engendred of the moouyng of the firste moueable, whiche being so greate of bodye, that it not onely compasseth all the Clementes, but also all the inferi-

Division of the ayre into three regions.

The hyghest ayre is incombustible.

The order of the heauens.

The firmament.

The planets.

The Crystalline heauen.

The heauen of water.

psalm. 148.

Daniel. 3.

The moouing of the firste moueable.

## The first part.

**The coldnesse  
of the Cris-  
talline heauen.**

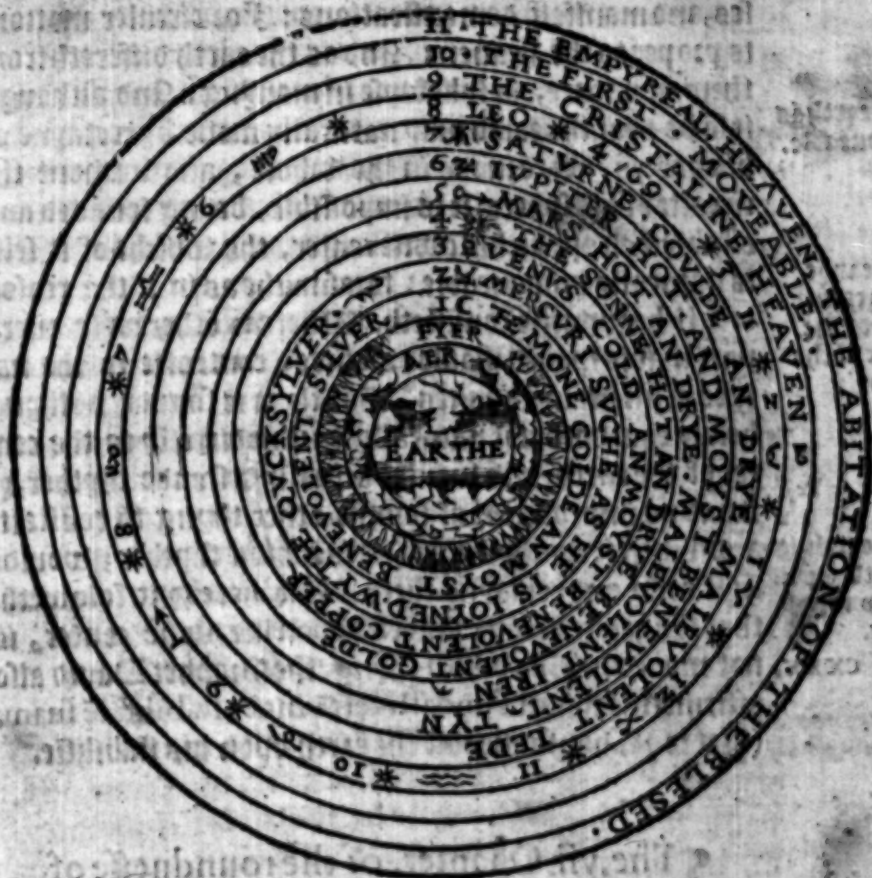
**The heauen  
of the fyrste  
moouable.**

**The heauen  
called Empe-  
rium, is not  
mooued, and  
is the habita-  
tion of angels.**

**The humani-  
tie of Christe  
in the Empe-  
rial heauen.  
Three orders  
of Angelles.**

**The Emperi-  
al heauen, pre-  
serueth all the  
other heauens.**

our heauens is moued so swiftly, that it dayly perfectlye  
mooneth all the aforesayde spheres. And least by reason of  
the greate heate thereof, caused by his swift motion, it  
shoulde consume inferiour thynges, God ordeyned this  
Cristalline heauen, that the coldnesse thereof might tem-  
per the extreame heate of the other. This Cristalline hea-  
uen, reacheth to the first moeable heauen, called Primum  
mobile. And this reacheth to the Imperial heauen, which  
is the twelfth, called Emperium, by reason of his cleare-  
nesse and resplendence. This is not mooued, and is most  
perfect. The Philosophers hadde no knowledge hercof.  
But we beleue by holpe Scripture, that suche a heauen  
there is, and the same to be the habitation of Angels, and  
spiritual creatures. It is also called Coelum coelorum, that  
is, The heauen of heauens: because it conteyneth & inclu-  
deth within it al the other heauens. It is of greater clear-  
nesse then all the other heauens, and was created immedi-  
ately with the Angels. In this also remaineth the huma-  
nitie of Iesus Christe our God, and in dignitie aboue it.  
It conteyneth thre holpe orders or principalities, called,  
Hierarchias. Whereof the firste is called supercelestiall,  
and hath in it also thre orders, Seraphims, Cherubims,  
and Thrones. The seconde is called Celestiall, and contey-  
neth Dominations, Principates, and Potestates. The  
thyrde, called Subcelestiall, conteyneth Virtutes, Arch-  
angelles, and Angelles. And to conclude, it hath a  
boundance of al goodnesse & perfect felicitie, with-  
out any want of al euyl. This heauen al-  
so geueth influence of constancie, stedfast-  
nes, and durabilitie to thynges, against  
the fluxibilitie and inconstancie of  
the other heauens: the order  
whereof, dooth appeare in  
the demonstration fol-  
lowyng.



The .vi. Chapter, of the immutabilitie  
or immobilitie of the earth.



**P**ythagorians and other  
ancient naturall Philosophers  
(as sayth Aristotle) were Opinion  
of opinion that the earth dyd  
move. Yet not by a ryght forth  
motion, but circularly about in  
mydd of one place. The whiche  
error, both Aristotle him selfe, e  
the

The earth is  
immoueable.

All heauye  
thynges en-  
cline to the  
center of the  
earth.

The earth is  
founded vpon  
his owne  
center.

Psal. cxxx.

the Astronomers do confute and reprove by euident cau-  
ses, and manifest demonstrations: For circular motion,  
is proper to the heauens. And as the earth differeth from  
them in nature, so lykelwys in mouyng. And although  
it so be that the earth may naturally moue by certayne of  
his partes, yet to moue in the whole, and without the  
circuite of his sphere, it is impossible, beyng founded and  
established vpon his owne center, the whiche of it selfe  
is naturally immoueable: forasmuche as in it the reason  
of all heauynesse consisteth. Whereas otherwys, every  
part that is moued shoulde ascende, contrarie to the na-  
ture of all heauy thynges. But there is founde nothyng  
heauy that both not naturally encline directly to the cen-  
ter of the earth, and woulde actually descende thither, yf  
it had no impediment of somme other thyng to resiste it:  
and when it toucheth there, or is comine thither, woulde  
styll reste and remayne there. And hereby it foloweth,  
that the earth, being founded vpon his owne center, is  
not moued. The which thyng, the prophet Dauid also  
affirmeth, saying: Fundasti terrā super stabilitatē suam,  
(that is.) Thou foundedst the earth vpon his stabilitie.

## ¶ The .vii. Chapter, of the roundnesse of the earth and water.

The round-  
nesse of the  
earth.

The rising  
of the Sunne.

The Eclipse  
of the Moone.



That the earth is rounde, it ap-  
peareth by manifeste euidence.  
For yf it were playne or flatter,  
the dawnyng of the day or day  
spring, shoulde equally and at  
one time appeare to them in the  
West, as to them in the East.  
But we see the contrary, that  
it appeareth fyrste to them that  
dwel in the East, & after ward to them in the West. This  
is proued by the Eclipse of the Moone, which begynnyng  
at one instant, they of Ierusalem see it begyn at foure a  
clocke of the night, & we of Andalusia in Spayne, at one a  
clocke

clocke of the nyght. It foloweth hereby, that to them it  
nyghteneth three houres sooner then vnto vs in Spaine:  
and this is caused by the roundnesse of the earth. It is  
also as well knowen to be rounde, from the pole Arctike, to  
the pole Antartike: for by the roundnesse thereof, is cau-  
sed the equalitie and inequalitye of the dayes and nightes.  
The same is lyke wyse knowen by the raysing of the  
pole aboue our Horizon. And that the superficiall parte

The equalitie  
of dayes and  
nyghtes.

The earth  
and the water  
are one rounde  
globe.



of the earth & water, is all  
one rounde and sphericall

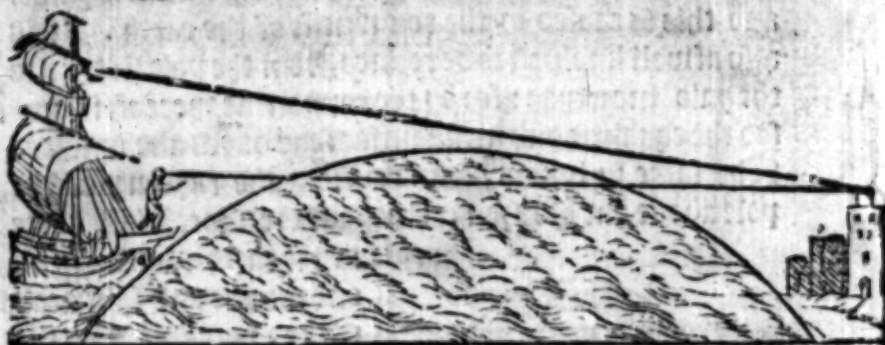
globe, is manifest by the  
shadowe thereof, being a  
certain darke body, reflect-  
ed fro the earth in the E-  
clipse of the Moone. For  
by this, as by playne de-  
monstratio, may we know  
that the earth is round, as  
may more manifestly ap-  
peare by this figure. It is

The water is  
also proued, & the water is a rounde body.

a rounde body, as is seene  
by experience. For yf you  
erect a marke vpo the sea  
banke of a port, & a shippe  
depart from that porte a  
certayne space: then stan-  
ding in y poupe or sterne  
of the shippe, you shal not  
see the marke aforesayde.  
But if you stande in y top  
of the ship, then may you  
see it. Whereas notwith-  
standing yf that portion  
of the bending arke of the  
earth, byd not hynder the  
sight you should see it bet-  
ter being in the poupe, for  
as muche as it is nearer to

## The first part.

the marke then is the top of the shyppe, as by this demonstration appeareth.



Nowe the  
earth is round

But here some may moue a doubt, saying, that on the earth we see many mountaynes, and consequently many great baileys and playnes, with many diuersities of sundrye other deepe and vnequall places, by reason whereof, the earth can not truly be called rounde. To this I say, that in two maners, the earth is called and vnderstood to be rounde. As after one maner, speaking precisely, it is called rounde, as a circle or a sphere, which we call rounde, because that all ryght lines drawn from the center thereof to the circumference, are equall. The other roundnesse, is considered without this precisenesse: and is suche, as not by all his partes is equally distaunte from his myddest or center, but hath some partes hygher, and somme lower: yet not in suche quantitie as may destroy the roundnesse of the whole. As yf in a bowle there were certayne clyftes or hoales, it shoulde not thereby leaue to be rounde, although not perfectly or precisely rounde. And for this cause sayth Auerrois, that although both the heauenly bodyes and the elementes are of round forme, yet dyffer they in this, that the heauenly spheres haue perfect roundnesse, and the elementes not. As the earth, by reason of his mountaynes and vales, the sea by his encreasynge, and decreasynge, the Ayre also for his nearnesse to the fyre, and by his contrarietie, doeth sometyme do, and sometyme suffer, (that is to saye) is sometyme actiue, and sometyme passiue. So that folowynge the one, it doeth the other, by reason whereof, it also lacketh

The ayre is  
actiue and passiue,  
and not  
perfectly  
rounde.

lacketh perfect roundenesse. But the fyre, for as muche as <sup>The fyre is</sup> it is neare to the concave of the Circle of the Moone, <sup>rounde.</sup> whiche is sphericall, maye therfore be called spherical or rounde.

The. viii. Chapter, of the motion  
of the heauens and Ele-  
mentes.



**L**is not to be forgotten, that al the Elementes are whollye mooueable by locall motion, excepte the earth. The water is mooued by the motion of the Moone, or tossed by the windes. <sup>Howe the fire is mooued.</sup> The fyre (as sayth Aristotle) is mooued circularly by the motion of the day, and is drawen of the circles that embrace it, or compasse it about: as is manifest by the Cometes, or blasynge starres, and other fyery exhalations, conteyned and engendzed in it: Whiche being carried with this motion, conclude, that the fire mooueth in lyke manner. And with this motion is the superiour parte of the ayre violently carried about, as the other impressions therein doo shewe. <sup>How the ayre is mooued.</sup> The inferiour part is mooued by diuers motions: (that is to meane) laterally, as by experientce we see when the wyndes blow. The Moone with her heauen or sphere, by her proper motion geueth her turne from the West to the East, in. xlvii. dayes, and seven houres, with. xlv. minutes. Venus, Mercurie, and the Sunne, in a yee: whiche is the space of thye. C. lxx. dayes, with v. houres, and. xlix. minutes. Mars in two peeres. Iupiter in xii. peeres. Saturne in, xxx. peeres. The viii. heauen, whiche is the firmamente, or starrie heauen, by his owne proper motion is mooued by the ix. heauen, vpon the begynnyng of Aries and Libra, and vpon these two poyntes accomplisheth his reuolution in seven thousande peeres.

The Moone.

Venus.

Mercurie.

The Sunne.

Mars.

The starrie heauen or firmament.

## The first parte.

**The Crista-  
line heauen.**

**Fyft mooue-  
able.**

**Howe the first  
mooneable  
draweth the o-  
ther heauens.**

This motiō is called *Motus trepidationis* (that is to say) the tremblyng motion, or motion of accesse & recesso. The nyynth heauen endeth his motion from the West to the East, in. xliij. thousand yeeres. And by this motion mooueth the egypt heauen. The tenth heauen, called *Primum mobile*, is mooued from the East to the West: and in xliij. houres (whiche is a naturall daye) perfourmeth one reuolution, and with the myghtie force and swyftnesse of his motion, carryeth with hym all the other inferiour heauens, and maketh them to geue the same turne in. xliij. houres, where as neuerthelesse they cease not in the meane tyme, to keepe the course of theyr owne proper motion. As (for example) yf an Ant or Wisnere should goe about the wheele of a Wyll, contrary to the moouyng of the wheele: before the Ant in goyng shoulde soe warde, shoulde come agayne to the point from whence she fyrst departed (whiche is once about, or one turne) the wheele shoulde in that space make many turnes.

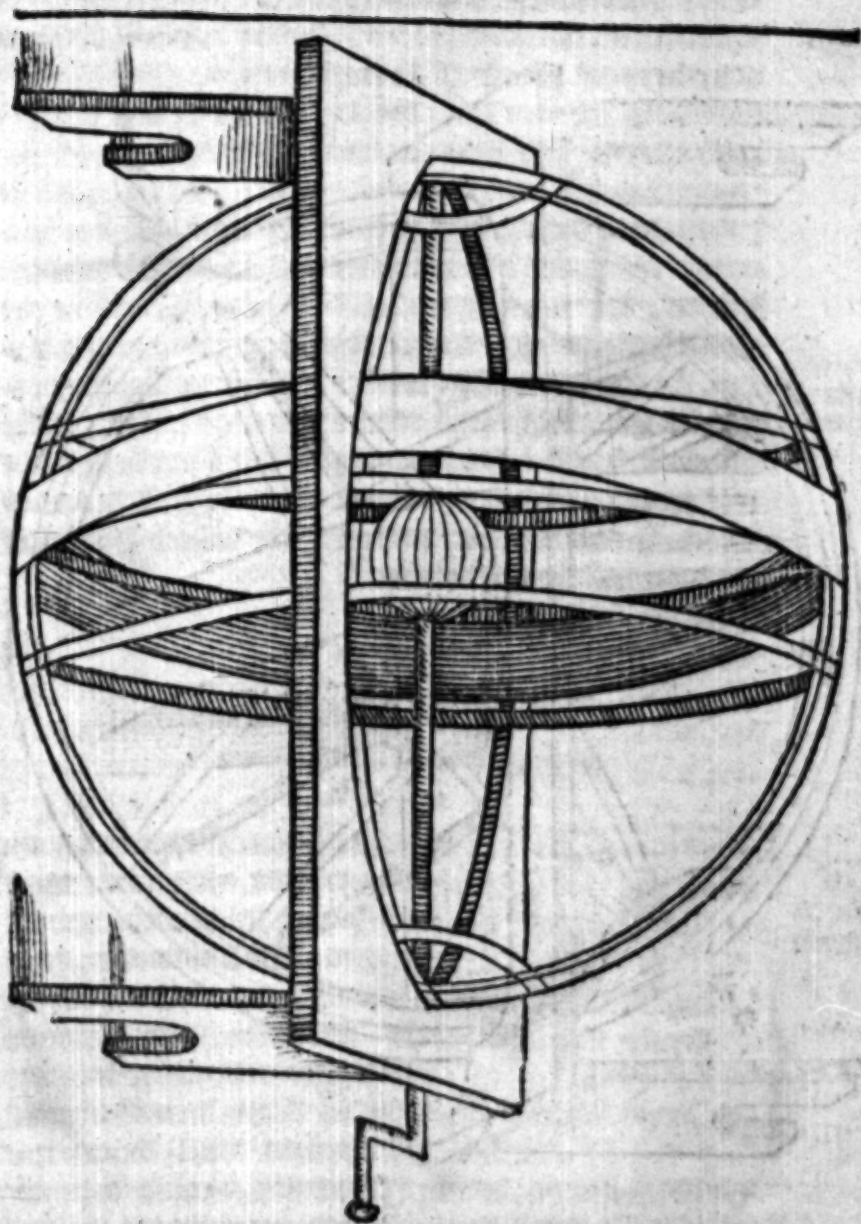
## The. ix. Chapter, of the diuision of the Sphere into foymall partes.

**The ryght,  
and crooked or  
oblique sphere**



**T**HE Sphere of the worlde, is diuided in two manners, (that is to say) by substance, and by accident. By substance, into .i. Spheres, as we haue sayde. By accident, into a ryght Sphere, and oblique or crooked Sphere. They haue the ryght Sphere that dwell vnder the Equinoctfall lyne, and is called ryght, because to them the Poles are equally in the Horizon, as appeareth by this figure folowynge.

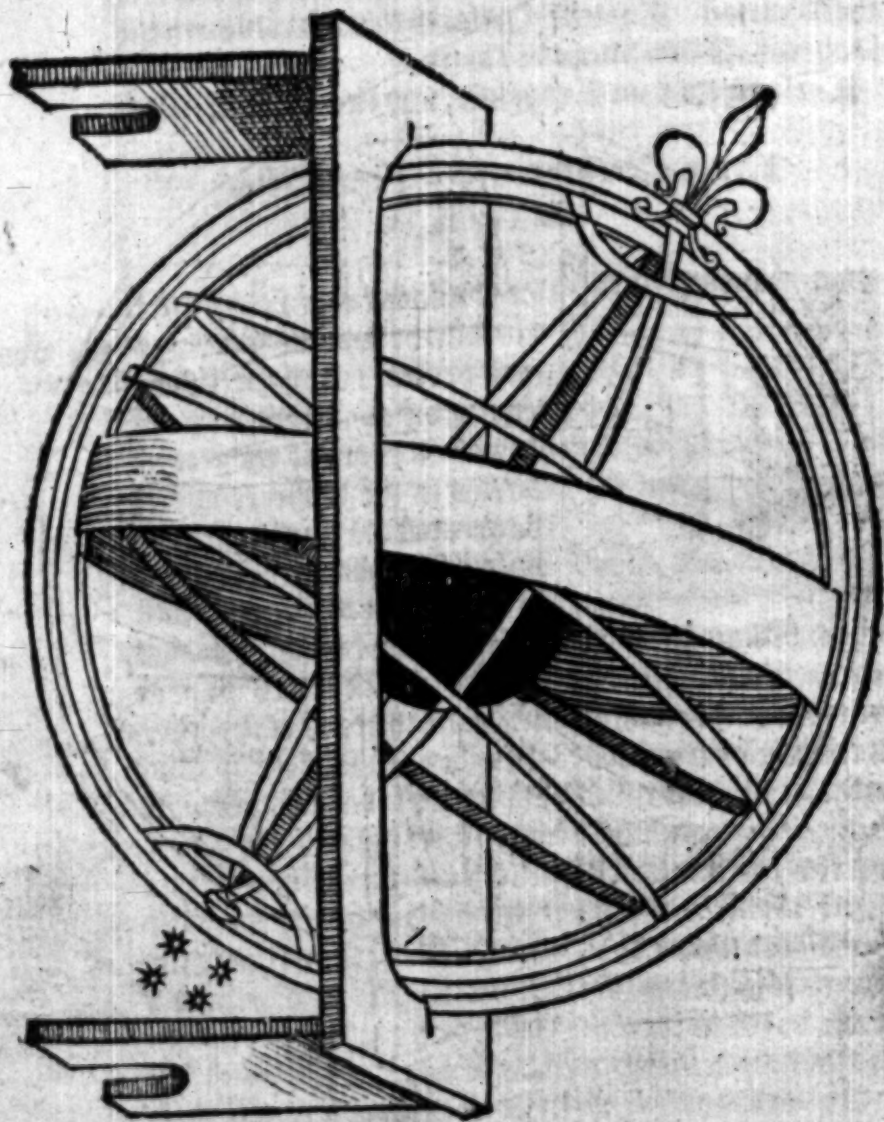
**The**



They haue the oblique Sphere that dwell eyther on this  
 syde of the other sydes of the Equinoctiall ; vnto whom The oblique  
or crooked  
is sphere.  
 B ii

# The first parte.

is euer one of the poles aboue the Horizon, and the other  
vnder it, as appeareth in this figure.



The .x. circles The sphere is compounded of .x. circles imagined. And (as  
sayth John de sacrobolco, in his booke of the sphere) are

of them are greater, and foure lesse. The greater Circle, is that which diuideth the Sphere into two equall partes, and hath his center with the center of it. These are the Equinoctiall, the Zodiac, the two Coluri, the Horizon, and the Meridian. The lesse Circle, is that that diuideth the Sphere into two vnequall partes.

These are the two Tropicke, and two Polar Circles.

The. x. Chapter, of the Equinocti-  
all Circle.



The Equinoctiall, is a Circle that diuideth the Sphere into two equall partes, & is by every parte equally distaunt from both the Poles. It is one of the greater Circles in the Sphere, and is the greatest Circle of those whiche are described in the Sphere, by the motion of Primum mo-

The Equinoctiall,

bile, or first mooueable. This Circle, for his equalitie, and regularitie, is more noble then the Zodiacke, which we haue described in the eighth sphere, & also then any of the other. It is imagined to gyde the worlde rounde about by East and West. It is called Equinoctiall, because this word Equinoctium, signifieth equalitie of nyghtes and dayes, whereof the cause is, that the Summe commyng to this Circle, the Arke of the day is equall with the Arke of the nyght: and then is the Equinoctial. It is also called the Zone, or gyrdle of the spher mooueable. For euen as a gyrdle dooth gyde a man by the myddest, so dooth this Circle gyde in the myddest betweene both the Poles, by on the which the first mooueable is mooued. One of these imagined on our parte of the Sphere, is called, Polus Arcticus, because it is neare vnto certayne starres, whiche the Astronomers call Arcturus, which is the great Beare. It is called Septentrionall, or Septentrion, because that rounde about it are mooued the vii. starres, whiche make the lesse Beare, commonly called Bozina, (that is, the

The equalitie of the day and nyght.

The first mooueable,

The Pole Arctike.

## The first parte.

**The borne.**  
**North starre.**

borne. The starre which is in the tayle of the lesser Beare, is called the North starre, because it is nearest unto the North Pole: the whiche Pole is a certayne poynt in the firmamente, whiche can not be seene, although the nyght be neuer so cleare. This starre (as the Poet Homer sayth) dooth mooue lytle or nothing, because of his litle distance from the Pole. The other Pole is imagined on the other contrary parte, and is called Polus Antarticus, of the woorde Ante, whiche signifieth agaynst, contrary, or opposite: because it is on the contrary parte from the Pole Artyke. It is also called the South Pole, because that from that part of heauen commeth the wynde, commonly called the South, and is lyke wyle called Meridional, because it is ryght South from vs. This is neuer serue to vs. They that dwell vnder the Equinoctial, or come nearer vnto this Pole Antartike, haue so a signe or marke to knowe it, foure starres, in fourme of a crosse. And when the greatest of these is lowest in the foote of the crosse, they say it is .xxx. degrees aboue the pole. And as we can not see theyr Pole from hence, so they can not see our Pole from thence.

**Pole Antar-**  
**tyke.**

**The crosse**  
**neare vnto the**  
**Pole. Antar-**  
**tyke.**

## The .xi. Chapter, of the Zodiacke Circle.

**Zodiack.**



**THE** Zodiacke is defined to decline or bende it selfe from the Equinoctial. It is a great Circle, whiche diuideth the Sphere in two equal partes, cutting the Equinoctial by oblique or crooked angles: So that being thus cut, or diuided by it into two equal partes, one part thereof de-

clineth toward the South, & the other toward the North. This Circle is called the Zodiacke, of this woorde Zon, which in the Greke tongue signifieth life, because that according to the moouing of the planets vnder it, is the life of

of inferiour creatures:  $\odot$  is so named of Zodion, whiche signifieth a lyping beast. And is therefore diuided into xii. equall partes, whereof euery parte is called a signe, and euery signe hath an especiall name of some beaste, in respect of some propertie agreeable to the same:  $\odot$  for the order and dispositions of the firste starres in those partes, somewhat representing the similitudes of suche beastes, it is called Zodiack. The Latins called this Circle, Signifer (that is) the signe bearer, because it carryeth these signes  $\odot$  images in it: also, because the twelue partes, into the whiche this Circle is diuided, are called the xii. signes. That parte which declyneth to the North, conteyneth. vi. signes septentrionall, and the other that declyneth to the South, conteyneth other. vi. called Meridionall. Furthermore, it is to consider, that the Zodiack may be diuided in two manners. One, by longitude or length into the xii. signes aforesayde, and euery signe is diuided into. xxx. degrees, whiche make. CCC. degrees. Lykewyle, euery degree is diuided into. lx. minutes, and euery minute into lx. secondes, and euery seconde into. lx. terces, and so to tenne. The other diuision of the Zodiack is, by latitude or breadth. By latitude it is diuided into. xii. degrees, and in it we imagine a lyne that diuideth his latitude by the myddest, hauing. vi. degrees on euery parte or side. And this lyne whiche diuideth into two equall partes the breadth or latitude of the Zodiack, is called the Ecliptike lyne, because that when the Sunne and Moone are directly diuided vnder this lyne, eyther ioyned together by conjunction, or diuided by opposition, the is the Eclipse of the Sunne or of the Moone. Under this Zodiack the seven planettes are moued. The Sunne also moueth in the mydd of the sayde Zodiack, alongest the Ecliptike lyne, not enclipping moze to the one part then to the other. But the other planettes doo sometime goe toward the North, and otherwhyles toward the South, and sometye also toward or trauerse the Ecliptike. It is lykewyle to be noted, that these signes wherof we haue spoken, are not the constellations or starres that make those figures, whiche the ancient Astronomers dyd appropriate to certayne beastes, and

The twelue  
signes of the  
Zodiack.

Howe the  
sunne is cause  
of generation  
& corruption.  
Diuision of the  
xii. signes.  
Diuision of  
signes into de-  
grees.

Diuision of  
the Zodiack  
by latitude.

The Eclips-  
tyke lyne.

The moouing  
of the sunne,  
and the other  
planettes in  
the Zodiack.

## The first part.

wh it the. xii.  
signes are.

The figures  
of beastes and  
other thynges  
imagined in  
heaven besyde  
the. xii. signes.

and other thynges. For these figures are mooned accordyng to the motion of the eyghth sphere, and passe from one signe of the Zodiack to another. As we see that the starre, called *Oculus Tauri*, (that is) the Bulles eye, is in two degrees of *Gemini*. And the two starres that are the head of *Gemini*, are in. xiii. and xvi. degrees of *Cancer*. And *Spica virginis*, (that is) the spyke of the *Virgyn*, is in xvi. degrees of *Libra*. And the heart of *Scorpio* in two degrees of *Sagittarius*. And by this order doo they passe from one signe to another: so that we maye not vnderstande the signes by these starres, but for the. xii. partes of the Arke of the Zodiack, takyng the begynning of the Equinoctiall of *Aries*. The names of these signes, with theyr caractes and qualities, are described in this table here folowynge.

Numb.	Names	Charac	Qualities.	Numb.	Names & char.	Qualities.
1	<i>Aries</i> .	♈	hot & drye.	7	<i>Libra</i> . ♎	hot & moyst.
2	<i>Taur</i> .	♉	cold and dry.	8	<i>Scorp</i> . ♏	cold & moyst
3	<i>Gemi</i> .	♊	hot & moyst.	9	<i>Sagit</i> . ♐	hot and dry.
4	<i>Cancer</i>	♋	cold & moyst	10	<i>Capri</i> . ♑	cold and dry.
5	<i>Leo</i> .	♌	hot and dry.	11	<i>Aqua</i> . ♒	hot & moyst
6	<i>Virgo</i> .	♍	cold & dry.	12	<i>Pisces</i> . ♓	cold & moyst

## The. xii. Chapter, of the Circles, called Coluri.



Here are two circles in þ sphere, called *Coluri*, so named of the Greke word *Colon*, which signifieth, a member: And of *Vros*, whiche signifieth a wyde Dre. The tayle of this beaſt, maketh a *Semycircle* or halfe Circle, not perfecte. And as this beaſt mooueth his tayle laterally or

lyke wayes, and not by longitude: euen so do the Colure  
 moue to vs, and are cut in ryght sphericall angles, bypon  
 the Poles of the worlde. The one passeth by the Poles of  
 the worlde, and by the pointes of the Equinoctials, and  
 is called the Equinoctial Colure: the other lyke wyse  
 passeth by the Poles of the worlde, and also by the Poles  
 of the Zodiacke, and by the pointes of the Solstitialles,  
 and is called the Colure Solstitiall, called Solstitium, as  
 Solis statio (that is) the standing, or staying of the Sunne:  
 because that when the Sunne cometh to this poynt, it  
 declineth no moze, but returneth towarde the Equinocti-  
 all. These circles diuide aswel the Equinoctiall, as the  
 Zodiacke into foure equall partes, by the poyntes of the  
 Equinoctials, and Solstitials. In the Colure Solstitiall,  
 are the greatest declinations of the Zodiacke, which are  
 two arkes of this Colure, conteyned betwene the Equi-  
 noctiall and the Zodiacke. And these arkes are equall to  
 the other two of the same Colure, included be-

The Equi-  
noctiall colure

The Solsti-  
tiall Colure.

The greatest  
declination of  
the Zodiacke.

twene the Poles of the worlde,  
 and the Poles of the  
 Zodiacke.

### ¶ The. xliii. Chapter, of the Meri- dian Circle.



The Meridian, is one of the great cir-  
 cles, imagined to traaverse the sphere  
 by the poles of the worlde, cutting  
 the same in two equall partes by the  
 Zenith or vertical poynt. It is called  
 Meridian for this effect: that where-  
 soener a man becometh, and at what  
 soener tyme of the yeere, when the  
 Sunne (by the mouyng of the first moueable) shall come  
 to his Meridian: to hym shall it be hygh noone at Middy-  
 day, and is therefore also called the circle of the Middy-  
 day, or noone.

Definition of  
the Meridian  
circle.

The Middy-  
day, or noone.

It is

## The first parte.

**Diuers M:  
ridiana.**

It is also to be noted, that there are as many Meridians, or Meridian lynes, as are differences of habitations by longitude: so that they that dwell in the East, haue other Meridians then they that dwell in the West: So that the interposition of the arke of the Equinoctial, betwene the Meridian of one citie, and the Meridian of the other, is called the difference of longitude from one region to another, and from one citie to another, as we wyl further declare hereafter.

## ¶ The .xiiii. Chapter, of the Horizontall Circle,

**Definition of  
the Horizon.**



**H**e Horizon (after the Astronomers) is a Circle whiche diuideth that parte of the heauen which we do see, from the other part whiche we see not, so that the sayde Horizon diuideth the sphere of the worlde, into two equall halfes, called Hemispheres. That halfe which we do see,

**Hemisphere  
of Horizon.**

is called the Hemisphere superior, and it whiche we see not, is called, the Hemisphere inferior. This Horizon, changeth to them that moue: for as one doth moue, his Horizon doth change. And hereof it commeth, that howe many places are vpon the earth, and the circumference thereof, it is possible there shoulde be so many Horizons. The Astronomers suppose the Horizon, after two maner of sortes, that is to say, a ryght Horizon, & an oblique, or crooked Horizon. The right Horizon, is to them whose Zenith or vertical point is directly in the Equinoctial: and this ryght Horizon, passeth by the poles of the world, and diuideth the Equinoctiall in ryght sphericall angles. The other oblique or declined Horizon haue they, vnto whom the pole of the world doth ryse aboue their Horizon. This Horizon is also called oblique, because it diuideth the Equinoctiall, in vnequall and oblique, or crooked angles.

**Diuers Ho-  
rizons.**

**The ryght  
and oblique  
Horizon.**

Also

Also it is to be understoode, that the Pole of the Horizon is called Zenith, or the verticall poynnt of heauen, perpendicularly, or directly ouer our head. Whereby is inferred, that as much as is the eleuation of the Pole of the world aboue the Horizon, so much is the distaunce of the Zenith from the Equinoctiall. For the Zenith by all his partes, is distant from the Horizon, by 90. degrees. And all other impediments excluded, we may euer see halfe the heauen. And in as much as anye shall passe from the Equinoctiall, towarde the one Pole or the other, so much falleth his Horizon vnder or beneath the Pole, toward the course he intendeth, and lyke wyse as much shall it be raysed aboue the contrary Pole, as shall appeare by a demonstration in the end of this Chapter. This Horizon is diuided by the Meridian, into two equall partes, that is to say, the East and West partes of the sayde Horizon. The East parte is, where the Sunne and Starres begyn to aryse to vs, and appeare to our sight. The West parte is, where the Sunne and Starres dooth set and begyn to be hid out of our sight, vnder the sayde Horizon. Moreover, it is to be understood, that there be two manners of the East and West, that is to say, the true East and West, or the vntue. The true East, is the poynnt in the East part of the Horizon, where it dooth cut with the Equinoctiall: for when the sunne is in the poynntes of the Equinoctials, then he ryseth in the poynnt of the true East. And lyke wyse is to be understood of the poynnt of the true West, to be in the West parte of the Horizon, where the Equinoctiall dooth cut with the sayde Horizon. The vntue East and West is variable, accordyng as the sunne ryseth and setteth daily in diuers poynntes of the Horizon, whiche is distant from the poynntes of the true East and West, sometymes more to the Northwarde, and sometymes more to the South.

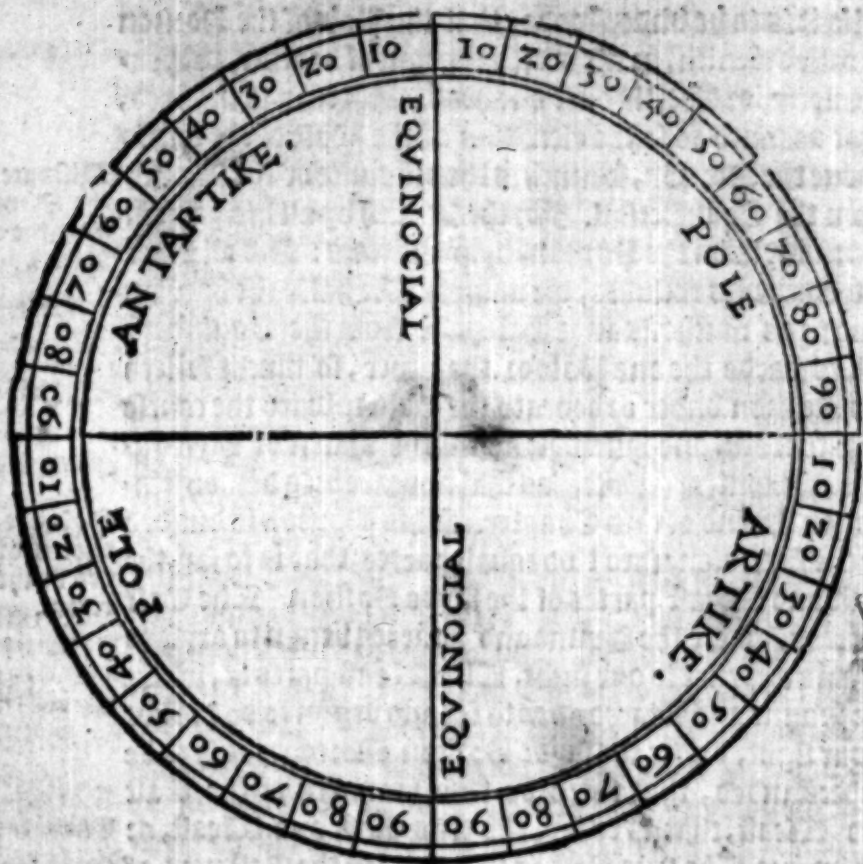
Distance of  
the Zenith  
from the Equi  
noctial.

How the Ho  
rizon is diui  
ded by the me  
ridian.

The true and  
vntue East  
and west.

The

# The first part.



## The.xv. Chapter, of the four- lesse Circles.

The lesse  
Circles.



Having entreated of the.vi.biggest Circles,  
it remaineth to speake of .i.lesse Circles.  
A lesse Circle (as we haue sayde befoze) is  
that, whose superficial diuideth the Sphere  
into vnequall partes, not passing by the  
center

center thereof. And of these, two are named Tropicke, so  
named of Tropo the Greeke word, which signifieth con- **Tropicke.**  
uersion: because the Sunne comyng to any of these Tro-

pykes, is conuerted, and turneth towarde the Equinoctial. These Tropicke are descrybed by the motion of the  
first moueable, with the pointes of the Solstitials. The  
one with the beginning of Cancer, and this is called the  
Tropicke of Cancer, or Equall, or sommer Tropicke.

The other is descrybed with the begynnynge of Capricorne, & is called the Tropicke of Capricorne, or Hemall,  
or wynter Tropicke. These two Tropicke and the Po-

lar circles (whereof I wyl say moze hereafter) are called  
Paralles: so named, so that they are equally distant by

theyr circumferences one from an other, and aswell from  
the Equinoctial. The Polar circles are descrybed in

this maner: so that as the Zodiacke declineth from the  
Equinoctial, so do the poles of the Zodiacke decline from

the poles of the worlde. And as the egypt sphere is mo-  
ued at the motion of the first moueable, so shall the Zo-

diacke moue, which is part of this sphere. And the Zo-  
diacke beyng moued, his poles shall lykelowse moue a-

bout the poles of the worlde. And as the poles of the  
Zodiacke are distant from the poles of the worlde. xxiii.

degrees and a halfe (whiche is almoste as the greatest  
declination) they shall descrybe certayne circles distant

from the poles of the worlde, in the selfe same. xxiii. de-  
grees and a halfe. These Polar circles, take thair name

or domination of that pole of the worlde that is moste  
neare vnto them, and therfore is the one called

Arctike, and the other

Antartike.

**Paralles.**

**The Polar  
circles.**

**The poles of  
the Zodiacke,  
and poles of  
the worlde.**

**The greatest  
declination of  
the Sunne.**

**Pole Arctike,  
and Antar-  
ctike.**

## \* The .xvi. Chapter, of the fyue Zones.

The

## The first part.

The sphere  
divided into  
foure Zones.



Zones habi-  
table and vn-  
habitable.

The diuision  
of the earth  
accorpyng to  
the fyue zones  
of heauen.

An errour of  
Ptolomie and  
the Astrono-  
mers.

The annient Astronomers diuided the sphere into .v. Zones. The fyrst, from the pole Artyke, to the circle Artyke. The second, from the circle Artyke, to the Tropicke of Cancer. The thyrde, from the Tropicke of Cancer, to the Tropicke of Capricorne. The fourth, from the Tropicke of Capricorne, to the circle Antartyke. The fyfth, from the circle Antartyke, to the pole Antartyke. Of these .v. Zones, they had certayne knowledge, that two of the poles were vnhabitable for extreeme colde: and also that the burnt Zone (called *Torrída Zona*) wherby the Sūne passeth by the myddest of them, shoulde be vnhabitable for extreeme heate. That from the Tropicke of Capricorne, vnto the circle Antartyke, they called deserte, because they knewe not that it was inhabited. And this our Zone, that is, from the Tropicke of Cancer, to the circle Artyke, they called inhabited or habitable. And to haue moze perfect knowledge hereof, it is to imagine, that the earth is diuided proportionally into .v. regions or portions, whiche aunswere directly to the sayde fyue Zones, as sayth the Poete *Duid* in this verse.

*Totidemque plage, tellure præmuntur.* that is. And so many regions, are on the earth beneath.

Euery of these regions or portions of the earth, is situate vnder one of the fyue Zones aforesayd. But wheras certayne men of auctorytie haue moued the questiō, whether the earth vnder the Zone, from the Tropicke of Cancer, to the circle Antartyke, is deserte or no: Ptolomie, and the Astronomers affirme, that is vnpeopled. But Aristotle, *Duid*, in the second of his *Metamorphoses*, *Plinie* also, and *John De Sacro bosco*, affirme the contrary: As for the moze certayntie therof, we knowe by the experience of suche as go and comme dayly from those partes. Mozeouer then this, we knowe that that lande is not only well replenished with people of good corporature, and of whyte colour, but the same to be also very rich in gold. For they that sayle to y<sup>e</sup> East Indies, touch in the cape of Buena

## The first parte.

Buena speranza or Caput bonæ Spei, whiche is in this zone. Likewyse the lande of Brasile, & the confines of Rio de la Plata, with al the coast, vnto the straighes of Magalhanes, euen vnto the .liiij. degrees of the South parte.

The lande of Brasile.

This land was discovered by Magalhanes, in yere. 1520. or. 1521. whereby that is now well knownen by sight, whereof Ptolome had no knowledge by heare say. The burnt zone (called Torrida zona) they also described to be uninhabitable, by reason of the great heate thereof, as Aristotle, Plinie, and in maner all other auncient authours asseyme: whereof the Poet Virgil wyrteth thus.

The straighes of Magalhanes.

Quinque tenent cœlū zonæ quarū vna corrusco.  
Semper sole rubens: et torrida semper ab igne.  
Which in the English tong, is thus much to say in effect.

In zones fīue, the heauens conteyned be,

Whereof the one with burnyng sunne is red:

Scorching so the earth subiect to his degree,

That so; the heate thereof it is inhabited.

Likewyse Ovide in his Metamorphoses, toucheth the same, saying.

Quarū que media est, & torrida sēper ab igne. &c

Yet that the burnt zone is inhabited, and well replenished with people that lye there, we knowe so certaynly by the number of them that dayly passe to and fro the Indies of your Maiesty discovered, in your most happy daies, that to say any thing to the contrary, it should bee a manifest error. And therefore is it greatly to be marueyled, that certayne wyse men haue asseymed these partes to be uninhabitable: whereas neuerthelesse they had knowledge of Arabia, Fœlix, Aethiopia, Taprobana, and dyuers other Regions situate vnder the burnt zone. Plinie wyrteth, that a shyppe came from the Sea of persia by the Ocean, rounde about Ethiope, and came to the pyllers of Hercules, which is now the Citie of Cadiz, where at this present I wyte this brieft treatise. They of Guenea, Calicut, Gatigara, and Malaca, lye all vnder the burnt zone, and many of them lye very long. And doubtlesse, many thinges ought to perswade vs, that vnder the burnt

The west Indies.

People of long lye vnder the zone.

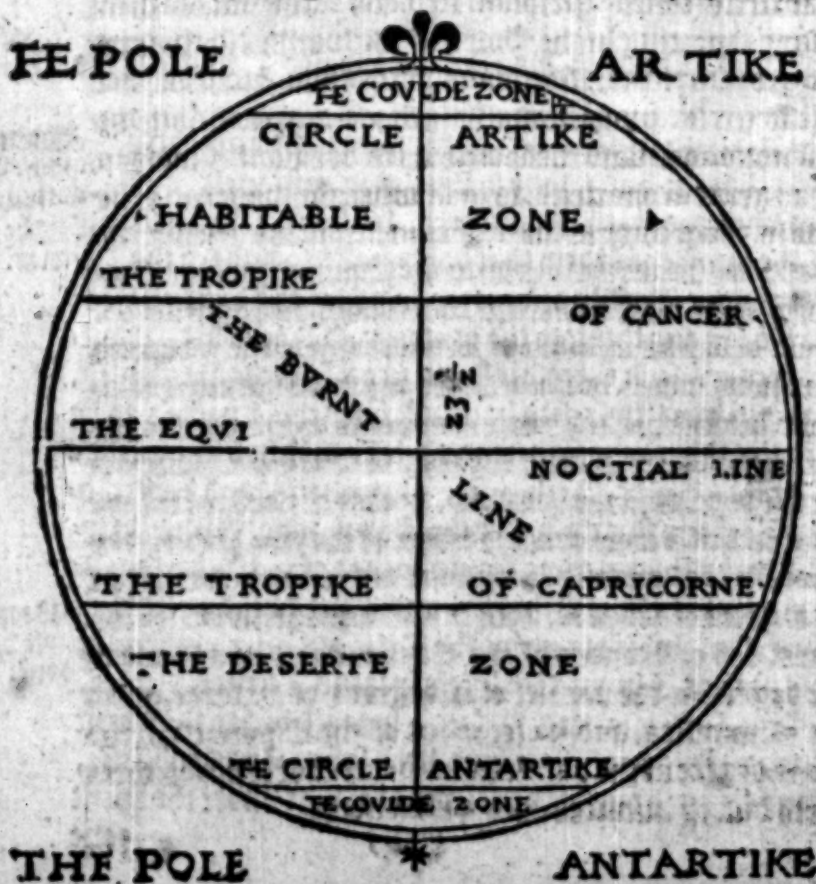
## The first part.

Some regi-  
ons habitable.

Ilande.  
Gothlande.  
Norway.  
Russia.

zone, the earth is furnished with all things pertaining to the life of man: for that in that region, or portion of the earth, is in manner continuall Equinoctiall, and the colde of the nyght doth sufficiently temper the heate of the day. Agayne, they that inhabite vnder that zone, haue two summers, and two wynters in the yeere: whereby is concluded that the auncient authours erred, not only in affirming this zone to be vnhabitable by reason of the great heate thereof, but in lyke maner erred, in affirming the zone that is betwene the circle Arctike, and the pole Arctike, to be also vnhabited by reason of great cold. The contrary whereof, we maye wel affirme, knowing as we knowe, that Ilande, with part of Gothlande, Norway, Russia, and ouers other landes are inhabited and well propledd.

¶ This is the figure and demonstration which foloweth.



The. xvii. Chapter, of longitude and latitude,  
and of the proportion whiche the lesse circles  
haue to the great circle.



The sphere or globe of the earth, is also diuided in breadth, & in length. The breadth (which is called latitude) is by degrees: for from the Equinoctiall, to eyther of the two poles, is 90. degrees. The length (whiche is called longitude) is by the degrees of the Equinoctiall, which is diuided in 360. degrees. The firste degree of longitude, both begin at a certayne Meridian, which passeth by the Ilandes of the Canaries, called the first Meridian: and the order of the numbering of the said longitude, is alwayes toward the East. By every degree of the sayde longitude in the Equinoctiall, maye be vnderstanded a great circle (called Meridian) to passe, eache one of them passing & meeting in the Poles of the worlde, so that the said great circles, or Meridians, both diuide euery paralel or lesse circle, proportionally into 360. degrees: but we must not vnderstand these degrees to be equall (that is to say) as great in one circle, as in another: for the greater the circle is, the greater is the degree in it: and the greater the paralel is, the nearer it is vnto the Equinoctiall line. Euery degree of the Equinoctiall, conteyneth in longitude, 60. minutes, so likewise it is to be vnderstanded of the degrees of latitude, which be diuided each one in 60. minutes of latitude, because the degrees and minutes in the greater circles, do not differ in their bignesse the one from the other: but the degrees in the paralels, as they are distant from the Equinoctiall, & come neare to either of the two Poles, they diminish consequently, so that one degree in the paralel, of vii. degrees of latitude, both make in quantitie but 59. minutes, and 33. secondes of the Equinoctiall circle: and to one degree in the paralel of 12. degrees of latitude, goeth but 58. minutes, and 41. secondes of the Equinoctiall, and to one degree in the paralel of 16. degrees of latitude, there goeth but 57. minutes, and 41. secondes.

The diuision  
of the sphere  
by longitude  
and latitude.

The degrees  
of the Equi-  
noctial circle.

**The first part.**

¶ The table of minutes, whiche euery degree  
conteyneth in euery of the paralelles.

1	59	59	16	57	41	31	51	26	46	41	41	61	29	5	76	14	31
2	59	58	17	57	23	32	50	53	47	40	55	62	28	10	77	13	30
3	59	55	18	57	4	33	50	19	48	40	9	63	27	14	78	12	28
4	59	51	19	56	44	34	49	45	49	39	22	64	26	18	79	11	27
5	59	46	20	56	23	35	49	9	50	38	34	65	25	21	80	10	25
6	59	40	21	56	1	36	48	32	51	37	46	66	24	24	81	9	23
7	59	33	22	55	38	37	47	55	52	36	56	67	23	27	82	8	21
8	59	25	23	55	14	38	47	17	53	36	7	68	22	29	83	7	19
9	59	16	24	54	49	39	46	38	54	35	16	69	21	30	84	6	16
10	59	5	25	54	23	40	45	58	55	34	25	70	20	31	85	5	14
11	58	54	26	53	56	41	45	17	56	33	33	71	19	32	86	4	11
12	58	41	27	53	28	42	44	35	57	32	41	72	18	32	87	3	8
13	58	28	28	52	59	43	43	53	58	31	48	73	17	33	88	2	5
14	58	13	29	52	29	44	43	10	59	30	54	74	16	32	89	1	3
15	57	57	30	51	58	45	42	26	60	30	0	75	15	32	90	0	0

**The. xviii. Chapter, of the circuite or compasse  
of the earth and water, according to the opinions  
of the auncient and latter authours.**



It may here appeare to be necessary for our purpose, to declare what space of the superficies of the earth or water, the auncient writers byd suppose to answere to one degree of a greater circle in the heauen : for in diuers countreys, they vsed to count by diuers sortes or manner of mea-  
sured by myles : the Grekes, by furlongs and Frenchmen, by leagues : and the Persians,

Miles.  
 Furlongs.  
 Leagues.

tures : as, the Latines counted by myles : the Grekes , by furlonges: the Spaniards and Frenchmen, by leagues: the Egyptians, by signes or markes : and the Persians,

by fagunes. But they all agree, that foure graines of barley make a fenger breadth, foure fengers, a bande breadth, foure bandes a foote, fyue foote, a Geometrical pafe (for two fimple pases, make fyue fete.) Also. 125. Geometrical pases, make a furlong. viij. furlonges, one myle, which is a thoufande pases: and three myles, one league. In Germanye they make leagues of moze fete, and in fome places moze then in other. In Fraunce, they count .xxx. leagues, to one degree. The Spanyardes, count .xviij. leagues and two terces, and .xviij. and a halfe for a degree of the great circle: this difference that one league is bigger then another, may come hereof, that one barley corne is bigger then another. But to our purpose, let vs geue to every league three thoufande pases, and to every pafe fyue foote, and fo shall every league haue .xviij. thousand foote. In the Cardes of the sea, that haue they? degrees of .xviij. leagues and two terces, we say, that of these, the roundnesse of the lande and the water, conteyneth fyue thousand leagues. And in the Cardes that haue .xviij. leagues and a halfe for a degree, of these we say that it conteyneth fyue thousand and three hundred leagues. And who so desyeth to know howe much is the Diameter of the earth and water, maye knowe it by multiplying the circumference by seven, so that diuidyng the summe that ysleth thereof by twenty and two, the part that ysleth of that calculation, shalbe the Diameter: and the halfe thereof, shalbe the semidiameter.

Graine,  
Fenger.  
Foote.  
Pase.

The degrees  
of the Sea  
cardes.

The Diameter  
of the earth  
and water.

## ¶ The .xix. Chapter of the seven

### Climates.



The ancient authours dyd also diuide that part of the superficies of the earth, on the North syde of the Equinoctial, which they supposed to be mozte habitable, into seven Climates, wherein they did finde to be dyuers conditions and customes of men, and diuersities of beastes, and of other natural things: the which thynges they perceaued to haue a diuersitie in the countreys, as

Diuision of  
the earth and  
water by cli-  
mates.

Diuersities of  
thynges in dy-  
uers climates.

## The first part.

What is a climate  
Difference  
of dayes.

The space of  
seuen climates

The quantitie  
of the lesse  
circles.

The latitude  
of Climates.

where the day of the one dayd increase or differ, above the day of the other by halfe an houre, so that the space of the superficial of the earth betwene two parallel lines, where in the longest day both increase or differ by halfe an houre, is called a Climat. The place where they suppose the first Climat to begyn, is distant in Latitude from the Equinoctial by 12. degrees and 45. minutes, where the longest day is .xii. houres, and 45. minutes, & the place where the last Climat both finishe, is in the Latitude of 50. degrees, and 30. minutes, where the longest day is .16. houres, and 15. minutes, so that the increase of the longest day in the ende of the seuenth Climat, both excede it in the beginning of the first Climat, by threes houres and one halfe: and the whole compasse of the earth, with al the seuen Climates, doth contayne in breadth, 37. degrees, 1. 45. minute, but their length is supposed to extend to 180. degrees of longitude. In that maner, a Climat, the nearer it is vnto the Equinoctial, the more it conteyneth of the superficial of the earth, because the paralel circles, the nearer they be vnto the Equinoctiall, the greater is the compasse of the earth which they make in length, & the lesser the compasse is, the nearer they be vnto the poles, as doth appere evidently by the Meridians, where they do all concur, and meet in the poles, their distances wareth continually lesser & lesser, the nearer they be vnto the sayd poles, so that the nearer the Climat is vnto the pole, the lesser it conteyneth of miles in the length. In lyke maner shall you vnderstand, that greater is the breadth of the first climate, then of the seconde, and the seconde then the thyrde, and lyke wyse of the other. For in howe much the more the Equinoctiall you come neare to the pole, so muche the more is the sphere oblique or crooked, and consequently the daye increaseth more: by reason wherof, in lesse space is found the increase of halfe an houre, in whiche the Climat maketh difference and doth varye. Which thing shall be more manifest to hym that beholdeth the latitude of them all, as may appere by the Table here folowynge: In whiche you may see the houres whiche the greatest daye conteyneth of every climate in his beginning, myddest, and

and ends, with also the eleuations of the Pole, or distance from the Equinoctiall, and also the degrees of latitude, whiche every climate conteineth.

Climates	The longest day.						The eleuation of the pole.						Differences of latitude	
	Beginnyng	Midst	Ende	Beginnyng	Midst	Ende	Beginnyng	Midst	Ende	Beginnyng	Midst	Ende		
Firste.	12	45	13	0	13	15	12	45	16	40	20	30	7	45
Seconde.	13	15	13	30	13	45	20	30	24	15	27	30	7	0
Thirde.	13	45	14	0	14	15	27	30	30	45	33	40	6	10
Fourth.	14	15	14	30	14	45	33	40	36	24	39	0	5	20
Fyft.	14	45	15	0	15	15	39	0	41	20	43	30	4	30
Syxt.	15	15	15	30	15	45	43	30	45	24	47	15	3	45
Seuenth.	15	45	16	0	16	15	47	15	48	40	50	30	3	15

The first climate, is called Diameroes, Meroe is a citie Diameroes, of Aphyske, vnder the burnt Zone, on this side the Equinoctiall is. degrees.

The seconde, is called Diasyena, Syena is a citie in the Diasyena, confines of Ethiope, where there is a well that sheweth the Sommer solstitial, because that place is vnder y circle of the Tropike of Cancer, and the sunne seemeth to stand directly ouer that place at mydday of y solstitial, whereby the well is then very cleare, and hath in it no shadowe at all: as the Poet Lucan maketh mention in Farsalia, where he sayth.

Vmbra nusquam flectentes.

That is to say, shadowes no where reflecting.

The thirde, is, Dia Alexandros, Alexandria is a famous citie in Aphyske, buylded by great Alexander, & is the cheefecitie or Metropolis of Egypt.

The fourth, is, Dia Rhodos, Rhodes is an Ilande of Asia the lesse, where were sometyne the knyghtes of the Rhodes, called the knyghtes of the order of Saint John, or knyghtes of Jerusalem, who were driven from thence, when the Ilande and Citie was taken by Soltan Suliman the greates Turke, in the yere. 1522.

E iiii

Philippe

Turke.

## The first parte.

Philippe Vrlerio Frenchman, beyng then graunde master of the Rhodes: within this fourth clime, is the Citie of Ierusalem, within the holy lande called Palestina, and also a great part of Spayne, with many other prouinces.

**Dia Romes.**

The fyfth, is Dia Romes, Rome is the mosse famous citie of Italie, and most notozious of al Europe, sometime the head of the worlde, dominatrix of nations, and nowe the sea of the Bishop of Rome.

**Dia Boristhenes.**

The syxth, is Dia Boristhenes, Boristhenes is a greatespouer of Scithia, the fourth arme of the spuer Istro. It falleth into the sea Euxinum: and where as al other rivers of Scithia are troubled, this is cleare and sayre, also whole, some to be drunke, and full of fishe.

**Dia rifeos.**

The seuenth, and last climat, is called Dia Rifeos: The mountaynes called Rifei, are famous in the part of Europe, called Parmatia, and are continually covered with snowe. Out of these, spyngeth the spuer Tanais, well known in the worlde by fame. When it is wyrtten with phi, it is the name of certaine mountaynes of Archadia.

**The spuer Tanais.**

And here ought we not to be ignozant, that wheras the auncient authours assigned onely seuen climates, they might haue made many moze. And for that they iudged the parte of the Pole Antartike not to be inhabited, they assigned no climates thereto. Stoflerine added the eyght climate, counting from thend of the seuenth climat, vnto

**Stoflerine.**

**The Peridionall, or South climates.**

57. degrees: and other added moze. In like manner describing Peridionall, or South climates, we call them by the selfe same names, as we dyd the aforesayde Septentrionall, or North climates: sayng that it is necessarie to put befoze euerye of them, this Greke pzeoposition Anti, whiche in the Latin tongue, signifieth Contra, or Contrarium (that is) contrary, or agaynst. So that as we named the first North climat, Dia Meroes, we must to the first of the South, adde this woorde Anti, and so shall the firste South climat be named Anti Diameroes: The second, Antidia Siene, and so forth of the other, as is scene in the figure here folowng.

**The**

POLE

ARTIC



POLE

ANTARTIC

The.xx.Chapter, of certayne principles,  
that ought to be knowen for this science.



¶ treatyng of the Sphere, we  
hane spoken of Circles, Cir-  
cumferences, Centers, Diame-  
ters, Lynes, with suche other  
wordes, appropriate to this  
science: The whiche, what they  
are, it is conuenient farther to  
declare.

A right lyne, is a short exten- A right lyne.  
tion from point to point.

An angle, is the touchyng of lynes in one superfiell, In angle.  
whose

## The first part,

**Solide.**

whose touch shal not be direct: for if it be, it shal be a lyne, & not an angle. Solide is a body, whiche by dimensions hath length, breadth, and depth.

**A circle.**

A circle, is a playne figure, conteyned vnder a lyne drawn in compasse, in whose midst is a poynnt or p[ri]cke, from the whiche all right lynes comming forth to the circular lyne that compasseth it about, are equal.

**The circumference of a circle.**

The circumference of a circle, is a lyne that conteyneth the circle, (that is to meane) that lyne to the whiche all ryght lynes that proceede from the center of the circle vnto it, are equal: & this is called the roundnesse of the circle.

**The center of a circle.**

The center of a circle, is that poynnt or p[ri]cke from the whiche al ryght lynes proceeding vnto the circumference, are equall.

**Diameter.**

The Diameter of a circle, is a ryght lyne, whiche passing by the center of the circle, and extendyng his endes to the circumference, diuideth it in two halfes.

**Semicircle.**

The halfe circle, is a playne figure conteyned betweene the Diameter of the circle, and the halfe circumference.

**Zenith.**

Zenith, is a poynnt or p[ri]cke imagined in the heauen, directly ouer the top of any thing, as, if we shoulde imagine a ryght lyne to passe by the center of the earth, extended from thence directly to heauen, and passing through the feete and head of a man standyng vpryght, so that the extremitie or endes of this lyne, shoulde reache vnto, and touche the circumference of heauen: then the imagined poynnt or p[ri]cke of heauen, where the ende of the lyne toucheth, is called Zenith, or poynnt of the head, or verticall poynnt. The same is to be vnderstoode of a citie, or anye other thyng, when we speake of the Zenith thereof.

**Eccentricke**

Eccentricke, is a circle, which hath his center distant, or diuided from the center of the worlde, and is described in the heauen of the sunne, imagining a line from the center of the Eccentricke, to the center of the sunne, making a complete revolution at the proper motion of the sunne. In the other heauens, imagining a line from the center of his Eccentricke, to the center of his Epicycle: and beyng mooued a whole revolution at the proper motion of the Epicycle.

The

## The first parte.

The Epicycle, is a circle, or little roundel first in the depth of the Eccentrique: in which the Planet first, and nearest to his center, is moved circularly.

The Auge, is a point in the circumference of the Eccentrique, nearest unto the firmament: or it may be sayd, that the Auge is a point farthest distant from the earth. Aux in the Greek tongue, is as much to say, as the greatest longitude, or greatest elevation from the earth. The Opposite of Auge, is an other point in the circumference of the Eccentrique, nearest unto the earth, and furthest distant from the firmament.

¶ Here endeth the first part.

## ¶ The Second part, intreating of the Motions of the Sunne, and the Moone, and of the effectes caused thereby.

### ¶ The first Chapter, of the course of the Sunne in the Zodiacke, and of the effectes caused by the same.



I have briefly spoken of the Sunne and of the other heauens. But so much as the Sunne must be our mark, guide, and gouernour in Navigation, whereof we intende to geue perfect instructions, it shalbe necessary especially, and precisely, to declare the course and motions thereof. Therefore (as we haue sayd) the sunne is moved vnder the Zodiack, and vpon his poles in the lyne Eccentrique, passing by the .xii. signes, beginning in the first degree of Aries, where he maketh Equinox, that is to say, he maketh then the day equal to

The Sunne is the gouernour in Navigation.

The moving of the Sunne vnder the Zodiacke.

## The first part.

**The sommer  
Tropike.**

**Declination  
of the sunne.**

**The wynter  
Tropike.**

**The cause of  
increasing and  
decreasing of  
the dayes and  
nights.**

to the nyght in all places. When from Aries he entreteth and moueth into Taurus, appocheing nearer and nearer vnto vs on the South parte, whereby the length of the dayes are increased with vs, and the nyghtes are shortened. Then entreteth he into Gemini, and from Gemini, into Cancer, where in the beginning of the first degree, he maketh Solstice, and toucheth the Sommer, or Citinal Tropike, and then are the dayes longest with vs, and the nyghtes shortest. Then declineth he no further from the Equinoctiall: but returnyng towarde it, passeth by this signe, shortenyng the dayes to vs, and lengthenyng the nyghtes. From this signe of Cancer, it entreteth into Leo, & passeth by it into Virgo, and by it entreteth into the first degree of Libra, where he is in the Equinoctial, & then he maketh the other Equinox, so that the nyght is then equal vnto the day ouer al the worlde. And passing by this signe, goeth declining from the Equinoctial toward the pole Antarlike, increasynge the nyghtes to vs, & shortenyng the dayes: and so entreteth into Scorpio, and from thence into Sagittarius. And passing by it, entreteth into the first degree of Capricorne, to the Hyemal or wynter Tropike: and then are the longest nights vnto vs, and the shortest dayes. From hence he returneth towarde the Equinoctiall, shortenyng vnto vs the nyghtes, and lengthenynge the dayes. He passeth by this signe of Capricorne, and entreteth into Aquarius: and passing by it, entreteth into Pisces: and passing from thence, returneth to his first point of the Equinoctial of Aries, where he beganne. Wherby it foloweth, that as the Sunne goeth the halfe of the zodiacke on this part of the Equinoctial, and the other halfe on the other part of it, & in these halfes hath diuers declinations, is caused the increasynge or decreasing of the dayes and nyghtes, to one more, and to another lesse, accordyng as euery one with his Horizon discouereth of the course of the Sunne, by howe little or much that he is departed or distant from the Equinoctiall, or as the pole is raysed aboue his Horizon. So that when as to them that are on this part of the Equinoctiall, is the longest day and the shortest nyght: even so to them

on.

on the other part, is the longest nyght, & shortest day. And contrarywise, when vnto vs is the shortest day, vnto them is the longest. Whiche shal further appeare by euident demonstration in the last chapter of the third parte.

The discreete Reader shal here note, that the sunne is not mooued regularly in the Zodiacke, making so much by his proper motion in one day, as in the other, because his regular motion is in respect of the center of his owne proper sphere or orb wherein he is mooued, whose center is distant without the center of the worlde, toward that part of Cancer, so that the greater parte of his orb eccentricke, is toward the septentrional parte, where the sunne passing by the septentrionall signes, is more distant from the earth, and hath more to goe of his orb eccentricke, then being in the South signes: for passing by the North signes, he targeth 9. dayes more: to describe that halfe of the Zodiacke, then the other halfe toward the South part, and for that cause the sunne is more swifter in his motion in the Zodiacke one tyme then other, for his motion in one day in the South signes, shalbe greater then it is in one day in the North signes, as shal appeare in the table that foloweth: whose vse is, for the finding of the motion and true place of the sunne in the Zodiack for euery day of the yeere. And hereby it foloweth of the sayde vnequall moouing of the sunne, and by the oblique of the Zodiacke, certayne dayes of wynter, with theyr nyghtes, are longer then certayne other of Sommer, with theyr nyghtes, that is to say, that the day naturall in the wynter, dooth surmount that in the Sommer, because the ryght ascension, whiche aunswareth to one dayes motion of the sunne, being in the South signes, is greater then the ascension for one dayes moouing, being in the North signes.

The moouing  
of the sunne in  
the center of  
his sphere.

The

**The second part,**  
**The.ii, Chapter, of the true place of the**  
**sunne in the Zodiack.**

To finde the  
true place of  
the sunne.



The equation  
of the pēre.

**T**he true place of the sunne, is a  
 poynt or pycke in the Zodiack,  
 which is thus found: that draw-  
 ing a ryght lyne from the center  
 of the world, to the center of the  
 sunne, & carrying the same conti-  
 nually ryght forth vnto the Zo-  
 diacke, where this lyne sheweth  
 or toucheth, that is the true  
 place of the sunne. This place is founde in thre manners.  
 One way, by a table: another way, by an instrument: and  
 the thyrde way, by a certayne rule, to be bozne in memo-  
 rie. To finde the true place of the sunne by a table, seeke  
 in the table folowynge, the moneth that you are in, in the  
 fronte or head of the table, and the dayes of the moneth,  
 on the leaft side of the table. When directly agaynst the  
 dayes, vnder the title of the monethes, you shal finde two  
 numbers, which are the degrees and minutes of the signe  
 whiche you shal first finde, named ouer the head, or aboue  
 the sayde numbers. When to the degrees and minutes  
 whiche you shal finde, you shall adde the equation, that is  
 directly of the pere in the which you are, or seeke to know:  
 And this shal you seeke in the table of equations, which is  
 after this: and that whiche dooth amount or arise therof,  
 shalbe the true place of the sunne. And here is to be noted,  
 that in the common yeres, (whiche are they that haue  
 not the bisextile or leape yeres,) from the ende of Febru-  
 arie, vntyll the ende of the yere (I say of December)  
 shall euer one degree be diminished or taken a-  
 way: and the degrees & minutes that shall re-  
 mayne, is the true place of the sunne. How  
 to know this by an instrument & by me-  
 mozie, shalbe sayde in the seventh  
 Chapter.

The

The second part.  
The Table of the true place of the Sunne.

Fol. xxliii.

Monethes.	January.	February.	Marche.	Aprill.	Maye.	June.
Signes	Capric.	Aquarius.	Pisces.	Aries.	Taurus.	Gemini.
Days.	☾	♈	♉	♊	♋	♌
1	20	22	21	53	20	55
2	21	24	22	54	21	55
3	22	25	23	54	22	16
4	23	26	24	55	23	13
5	24	27	25	55	24	11
6	25	28	26	56	25	8
7	26	30	27	56	26	6
8	27	31	28	56	27	3
9	28	32	29	57	28	0
10	29	33	0	57	29	58
11	0	35	1	57	0	59
12	1	36	2	58	1	48
13	2	37	3	58	2	47
14	3	38	4	58	3	46
15	4	39	5	58	4	45
16	5	40	6	53	5	44
17	6	41	7	58	6	43
18	7	42	8	58	7	42
19	8	43	9	58	8	41
20	9	44	10	58	9	40
21	10	45	11	58	10	39
22	11	46	12	58	11	38
23	12	47	13	57	12	37
24	13	48	14	57	13	36
25	14	48	15	57	14	35
26	15	49	16	56	15	34
27	16	50	17	56	16	33
28	17	51	18	56	17	32
29	18	51	19	56	18	31
30	19	52		19	27	23
31	20	52		20	25	

**The second part.**  
**The Table of the true place of the Sunne.**

Monethes.	July.	August.	Septēber.	October.	Novēber.	Decēber.
Signes	Cancer.	Leo.	Virgo	Libra.	Scorpio.	Sagitta.
Days	1	2	3	4	5	6
1	18	26	18	2	18	4
2	19	23	19	0	19	2
3	20	20	19	53	20	1
4	21	17	20	55	21	0
5	22	14	21	53	21	58
6	23	11	22	51	22	57
7	24	8	23	48	23	56
8	25	5	24	46	24	55
9	26	2	25	44	25	54
10	27	0	26	42	26	53
11	27	57	27	40	27	52
12	28	54	28	38	28	51
13	29	51	29	36	29	50
14	0	48	0	34	0	49
15	1	46	1	32	1	48
16	2	43	2	30	2	47
17	3	40	3	28	3	46
18	4	38	4	26	4	45
19	5	35	5	24	5	44
20	6	32	6	22	6	42
21	7	30	7	21	7	41
22	8	27	8	19	8	40
23	9	25	9	17	9	39
24	10	22	10	16	10	38
25	11	20	11	14	11	37
26	12	17	12	13	12	36
27	13	15	13	11	13	35
28	14	12	14	10	14	34
29	15	10	15	8	15	33
30	16	7	16	7	16	32
31	17	5	17	5	17	31

# The Table of the Equations of the Sunne.

The peeres The equatio The The S. The The S. The peeres The equatio  
of our Lord to be added. peeres quation. peeres quation of our Lord to be added.

	6	9		6	9		6	9		6	9
1545	1	0	1581	1	16	1617	1	32	1653	1	48
1546		45	1582	1	1	1618	1	17	1654	1	33
1547		30	1583		46	1619	1	2	1655	1	18
1548		15	1584		32	1620		47	1656	1	3
1549	1	2	1585	1	18	1621	1	33	1657	1	49
1550		47	1586	1	3	1622	1	18	1658	1	34
1551		32	1587		49	1623	1	3	1659	1	19
1552		18	1588		33	1624		49	1660	1	4
1553	1	4	1589	1	19	1625	1	35	1661	1	51
1554		49	1590	1	4	1626	1	20	1662	1	36
1555		34	1591		49	1627	1	5	1663	1	21
1556		19	1592		35	1628		51	1664	1	7
1557	1	05	1593	1	21	1629	1	37	1665	1	53
1558		50	1594	1	6	1630	1	22	1666		38
1559		35	1595	1	51	1631	1	7	1667	1	23
1560		21	1596		37	1632		53	1668	1	9
1561	1	7	1597	1	23	1633	1	38	1669	1	55
1562		52	1598	1	8	1634	1	23	1670	1	40
1563		37	1599		53	1635	1	8	1671	1	25
1564		23	1600		39	1636		54	1672	1	10
1565	1	9	1601	1	25	1637	1	40	1673	1	56
1566		54	1602	1	10	1638	1	25	1674	1	41
1567		39	1603		55	1639	1	10	1675	1	26
1568		25	1604		40	1640		56	1676	1	12
1569	1	11	1605	1	26	1641	1	42	1677	1	58
1570		56	1606	1	11	1642	1	27	1678	1	43
1571		41	1607		56	1643	1	12	1679	1	28
1572		26	1608		42	1644		8	1680	1	13
1573	1	12	1609	1	28	1645	1	44	1681	2	0
1574		57	1610	1	13	1646	1	29	1682	1	45
1575		42	1611		58	1647	1	14	1683	1	30
1576		28	1612		44	1648	1	6	1684	1	15
1577	1	14	1613	1	30	1649	1	45	1685	2	2
1578		59	1614	1	15	1650	1	3	1686	1	4
1579		44	1615	1	10	1651	1	16	1687	1	32
1580		29	1616		46	1652	1	2	1688	1	8

## The seconde parte.

This Table of the Equation of the Sunne, serueth from the yeere of .1545. where it hath his roote 0; beginnyng, vntill .1680. and in the yeere of .1681. it shall retorne to the roote, adding thereunto one degree moze.

As for Example. In the yeere of 1681. adde one degree vpon the other degree that the roote hath, and so shal the yeere of .1681. haue two degrees of equation, and the yeere of .1682. shall haue one degree, and .45. minutes, whiche is to adde one degree vpon .45. minutes, that had the yeere of .1545. &c. And hauing passed other .136. yeeres. you shall retorne to the roote, adding two degrees.

### ¶ The thyrde Chapter, of the declination of the Sunne.

what is the declination of the Sunne



The declination of the Sunne, is the arcke of the greater circle, whiche passeth by the Poles of the worlde, included betwene the Equinoctial and the Zodiack. And here is to be noted, that whatsoeuer foure poyntes or pitches whiche are equally distant from the poyntes of Equinoxes (whiche are the beginnynges of Aries and Libra) shall haue equal declinations.

Whereof it foloweth, that the foure quarters of the Zodiacke haue equall declinations. And to auoyde prolixite, I will adde hereunto a table of the declinations of only one quarter of the Zodiacke, so that all hauing one selfe same manner of declinations, it may serue for all, and the order of it is this. The signes whose declination increaseth, are in the head or fronte of the Table, and the degrees of these signes descende by the left syde thereof. And the signes whose declination decreaseth, are in the soote of the Table, and the degrees of these signes, rise by the ryght syde of the same. The disposition of the Table beyng vnderstoode: then to knowe what declination the Sunne hath in euery degree of the Zodiacke, you ought to knowe the true place of the Sunne (as in the Chapter

Sig.	V	Δ	δ	μ	Π	γ	Sig.
nes.							nes.
0	0		11	30	20	12	30
1	0	24	11	51	20	25	29
2	0	48	12	12	20	37	28
3	1	12	12	33	20	49	27
4	1	36	12	53	21	0	26
5	2	0	13	13	21	11	25
6	2	23	13	33	21	22	24
7	2	47	13	53	21	32	23
8	3	11	14	13	21	42	22
9	3	35	14	32	21	51	21
10	3	58	14	51	22	0	20
11	4	22	15	10	22	9	19
12	4	45	15	28	22	17	18
13	5	9	15	47	22	25	17
14	5	32	15	5	22	32	16
15	5	55	16	13	22	39	15
16	6	19	16	40	22	45	14
17	6	42	16	57	22	52	13
18	7	5	17	14	23	57	12
19	7	28	17	31	23	3	11
20	7	50	17	47	23	8	10
21	8	13	18	3	23	12	9
22	8	35	18	19	23	15	8
23	8	58	18	34	23	17	7
24	9	20	18	49	23	22	6
25	9	42	19	4	23	24	5
26	10	4	19	18	23	26	4
27	10	26	19	32	23	28	3
28	10	47	19	45	23	29	2
29	11	9	19	59	23	30	1
30	11	30	20	12	23	30	0
Sig.	X	μ	ω	Ω	ϑ	ϕ	Sig.
nes.							nes.

Chapter passe is declared) for the day of y declination whiche you desire to know, and the signe which the sunne shal be found in that day, shall you seeke in the fronte or foote of the table. And if it be in y front, you shal seeke the number of the degrees on y least side. And if it shalbe at the foote of the table, you shal seeke it on the right side. When above or vnder the signe, in the front of that degree of the sayde signe, you shal finde two numbers, wherof the first is of degrees, and the seconde of minutes: and those degrees and minutes of declination the sunne hath that day. And this is vnderstoode without hauing respect to the odde minutes above the degree, which the true place of the sunne hath.

And yf you desire to verifie this more precisely, note the declination of that

## The seconde parte.

that degree, and of the degree folowynge: and take the lesse from the moze, and that whiche remayneth shalbe the difference of the declination from the one degree to the other, of whiche difference ye shall take a parte proportionally as are the minutes of the place of the sunne vnto. 60. And this part of minutes must be added to y<sup>e</sup> first declination of it, and be lesse then the second, or must be taken from it if it shalbe greater, and then that riseth thereof, shalbe the precise declination for that signe, degree, and minute. As for example. In the yeere. 1545 the tenth day of September, the sunne shalbe in. 26.  $\odot$ . 38.  $\text{P}$ . of Virgo, & to the 26.  $\odot$ . precise, shal correspond. 1.  $\odot$ . 36.  $\text{P}$ . of declination. And to verifie the declination that commeth to. 38. minutes, which is moze of the. 26.  $\odot$ . you must marke the difference that is from the declination of. 26.  $\odot$ . (whiche is one  $\odot$ . 36.  $\text{P}$ .) to the declination of. 27.  $\odot$ . whiche is. 1.  $\odot$ . 12.  $\text{P}$ . The difference is. 24.  $\text{P}$ . Of these you must take such part proportionally, as the. 38 minutes beareth vnto. 60. which are almost two terces of a degree. Then the two terces of. 24. are. 16. which must be taken from one degree. 36.  $\text{P}$ . which correspond to the. 26.  $\odot$ . of Virgo, because the declinations go decreasing, & remayneth. 1.  $\odot$ . 20.  $\text{P}$ . and if the declinations increase, you muste adde thereto, as you take away when they decrease.

An other example for this yeere of. 1561.

Example for the yeere. 1561, the. 22. of April, I find y<sup>e</sup> true place of the sunne at noone, in. 9. degrees. 54. minutes of Taurus: then in the table of signes present, I seeke for the. 9. degree of Taurus, to whiche dooth answere for the declination. 14. degrees. 32. minutes, & to the next degree folowing, dooth answere. 14. degrees. 51. minutes: then take the lesser out of y<sup>e</sup> moze, so resteth. 19. minutes. Then frame a rule of. 3. & say, if. 60. minutes geue. 54. minutes (whiche 54. minutes dooth rest befoze of the. 9. degree of Taurus) how many doth. 19. minutes geue, which. 19. minutes are y<sup>e</sup> diuersitie of the. 9. and. 10. degrees of Taurus. So I finde that. 19. minutes geueth. 17. minutes, & 6. secundes, whiche 17. minutes, & 6. secundes, I adde to the. 14. degrees. 32. minutes, whiche aunswereth to the. 9. degrees of Taurus  
And

And that cometh to .14. degrees .49. minutes, and 6. seconds, which is the true declination for the .20. daye of Aprill. Anno. 1561.

It is also to be noted that I adde these .17. minutes, and 6. seconds, because the declination both encrease: for if it decreased, it were to be taken out so much, and the residue is the declination, so is the declination for the .20. of Aprill, in the yeere .1561. 14. degrees .49. minutes, and 6. seconds.

¶ The .iiii. Chapter, of the entraunce of the Sunne into the .xii. signes. And of the Equinoctials, and Solstitials, which diuide the foure tymes of the yeere.



¶ That is sayde in the Chapter before, it soloweth, that the Sunne entryng into the foure principall signes, causeth the foure tymes of the yeere. For entryng into Aries, it chaungeth the tyme to be from wynter to the spryng tyme. And entryng

The entrance of the Sunne into the foure principall signes.

into Cancer, it chaungeth the tyme from spryng to Sommer: and entryng into Libra, from Sommer to Autumne. Like wyse entryng into Capricorne, it chaungeth from Autumne to Wynter. So that when to be that be on the part of the North, is Sommer, then is it Wynter to them that are in the South part. Contrary wyse, being Sommer to them on the South, it is Wynter to them on the North. The entraunce of the Sunne into these signes, and all other of the Zodiacke, hath not ben euer at one selfe same tyme of the yeere. The cause of this is, that the Latin yeere is not equall with the moving of the Sunne in the Zodiack, as shalbe sayde in the .i. Chapter, where we wyll entreat of the yeere. In the tyme that Christe our redeemer was borne, were the Equinoctialles. The one at the .viij. of the Kalendes of Aprill, and the other at the .v. of the Kalendes

The Latin yeere.

The Equinoctials in the yeere of Christe.

## The seconde parte.

The Solsticial.

kalendes of October: so that they had the Equinoctial of the spring at the .xxv. of Marche, and the Equinoctial of Autumne, at the .xxviii. of September, as wyrteth John Baptist Capuano vpon the seconde Chapter of the sphere of Iohan. de sacro bosco. They iudged then the Solsticials: as that of the Sommer, at the eyght dayes of the Kalendes of Iulge, whiche is the .xxiiii. of Iune: the other of the Wynter, they iudged at the eyght dayes of the Kalendes of January, whiche is the .xxv. of December. And here wyl I not omitt to saye holwe in those tymes, at these foure dayes (that is to meane, in the two Solsticials, and two Equinoctials) were celebrated, or byd chaunce foure marueylous thynges in the worlde.

Foure notable thynges.

For in the spring Equinoctial, whiche was at the .xxv. of Marche, the Sonne of God was incarnate, and afterwarde borne of the Virgyn Marie in the Solsticial of Wynter, whiche was at the .xxv. of December. In the Equinoctial of Autumne, which was the .xxviii. of September, was conceived blessed John Baptist, the cryer and precursour of Christ, and was borne in the Sommer Solsticial, that was the .xxiiii. of Iune. And this is the first moneth, whereof S. Luke speaketh in the Gospell. Whiche thyng also John Chrysostome doth verifie, saying, that S. John was borne when the dayes began to decrease: and our Lorde when they began to increase. And it may certaynly seeme woorthie to be had in memorie, that in the sayde Equinoctial of the spring, Christ suffered, Adam was created, and loste the estate of Innocencie, Abell was slayne, Melchisedech offered breade and wyne, Isaac by Abraham was brought to be sacrificed, John Baptist was beheaded at Macherunta, Peter deliuered out of prison, Saint James beheaded by Herode, the good theefe enioyed Paradyse, and the bodies of many saintes rose with Christ. And who so further desyeth moze pccisely to knowe the entraunce of the Sunne into Ardes, and into the other principall signes, shall in the thyrde parte of this woork in the .viii. Chapter, fynde rules whiche shall byng hym to the knowledge

To knowe moze pccisely the entraunce of the sunne into the foure principall signes.

ledge thereof. But to returne to our tyme, I saye, that this present yeere of. 1545. the sunne entreth into the firste degree of Aries, at the tenth of Marche, at foure of the clocke at after noone: and into the first degree of Taurus, the nyenth of Aprill. 20. houres, and seuen minutes. And into Gemini the 11. of Maye, two houres, and fyve minutes. Into Cancer, the 11. of June 14. houres. 44. minutes. Into Leo, the 13. of July. 3. houre. 50. minutes. Into Virgo, the 13. of August. 9. houre. 56. minutes. Into Libra, the 13. of September. 4. houre. 4. minutes. Into Scorpio, the 13. of October. 7. houre. 13. minutes. Into Sagittarie, the 12. of November, iuste at noone. Into Capricorne, the 11. of December. 8. houre. 16. minutes. Into Aquarius, the 9. of January. 2. houre. 1. minute. Into Pisces, the 8. of Februarie. 1. houre. 30. minutes after mydday, (that is to saye) from noone. 1. houre. 30. minutes. And that we maye in the yeeres to comme, knowe the daye, houre, and minute, in the whiche the sunne entreth into euerye signe, we wyll folowe this order. Upon the dayes, houres, and minutes, that the sunne entreth into euerye signe this sayde yeere. 1545. we muste adde for euerye yeere, fyue houres, and. 49. minutes, which with the. 365. dayes, whiche euery yeere conseyneeth, shalbe the tyme in the whiche the sunne accomplissheth his reuolution. And because that in the yeere of the bisextile or leape yeere, is added to Februarie one daye more to his. 28. whiche he hath once in foure yeeres from. 6. to. 6. houres, yf we shall take from the computation, that whiche we haue geuen hym, turnyng one daye backward (as shalbe in the yeere. 1548.) and vppon that that remayneth, shall returne in the yeere following of. 1549. to adde fyue houres. 49. minutes, and as muche more euery other yeere following, shalbe a certayne rule for ever.

To knowe  
when the  
sunne entreth  
into euerye of  
the. xii. signes.

Leape yeere.

And it is to note, that the degrees and minutes whiche we haue touched before, are properly for the citie of Cadiz; and yf we desyre to applye them for other citiees or places more Eastwarde: then for euerye. xv.

## The second part.

**Variation of  
houres by the  
rapt mouyng  
of the Sunne  
from East to  
weast.**

degrees that they are distant from Cadiz in longitude, we must adde one houre. And yf for Cities or places more Weastwarde, in lyke manner for euerye .15. degrees, we muste take away one houre, by reason of the course of the Sunne, by his rapte moving from the East to the Weast: For it is certayne, that when with vs in Cadiz it is .xii. houres of the clock, to them that are .15. degrees Eastward from vs, it is one of the clocke: and to them that are from vs .15. degrees towarde the Weast, it is .xi. of the cloke.

**The entrace of  
the sunne into  
the .iiii. princ-  
pall signes,  
causeth the  
change of time**

Nowe that we haue rules to knowe the entraunce of the Sunne into the .xii. signes, thereby may we also know his entraunce into the foure Cardinal or principall signes, whiche are they that determine and ende the Equinocti-  
alles and Solstitialles, wherby are caused the foure times of the yeere. And for as muche as the generall chaunge of tyme, is, by reason of the Sunne, who by his comming neare, warmeth: by his remaynyng, dryeth: with his departure, cooleth: and by his long taryng away, causeth moystnesse, we will shewe the qualities of the principall wyndes, elementes, regions, humours, and agies, in one breefe table, and then consequently in another will we describe the begynnyng, mydd, and ende of the foure times of the yeere, as well in the monethes, as in the heauenlye signes.

**The Table of the qualities of  
the Elementes.**

Qualities.	Hot & drye.	Hot & moist	Cold & moist	Cold & drye
Partes of the yere.	Summer.	Spring.	Wynter.	Autumne.
Principall wyndes.	East.	South.	Weast.	North.
Elementes.	Fire.	Ayre.	Water.	Earth.
Regions.	East.	South.	Weast.	North.
4. Humours.	Choler.	Blood.	Fleame.	Melancholy.
4. Agies.	Youth:	Prime of Age.	Old.	Age.

The Table of the foure tymes of  
the yere.

Tymes.	Beginnyng.	Middell.	Ende.
Spring.	Marche. Aries.	April. Taurus	May. Gemini
Summer.	June. Cancer.	July. Leo.	August. Virg.
Autumne.	Septemb. Libra.	Octob. Scorpio	Novem. Sagit.
Wynter.	Decemb. Capricor.	Janua. Aquar.	Febru. Pisces.

The. v. Chapter, of the moone, and  
of her motions and properties.



In the Chapters paste of this seconde parte, we haue entreated of the sunne, and of his motions & effectes, as the most noble and principall luminarie. In this present Chapter, we wyl in-  
treate of the moone, whiche is the se-  
cond luminarie, although in the order  
of the beauens, she is first and nearest vnto vs of al other  
planettes or starres. The moone therfore is a round body,  
of beaunty substaunce, solide and darke in respect of the  
sunne, hauing no proper lyght of her owne, but is apte to  
receaue lyght. She is moued from the West into the  
East, accordyng to the order of the signes every day. 13. de-  
grees, litle more or lesse, and somewhat more then. 10. mi-  
nutes, by the proper motion of the beauen or sphere vpon  
the axis & poles of the zodiack. I sayd more or lesse, because  
that ouer and besyde the mouing of her deferent or circle,  
whiche is moued every day the aforesaid. 13. degrees, and. x.  
minutes, almoste. 11. she hath an Epicycle, where the moone  
is fixed: at the motion whereof, sometimes she is moued  
more swifely, & sometimes more slowly. Peruerthelesse, ac-  
cording to her mid motion, she maketh her course in. 27.  
dayes, and almoste. 8. houres: and hauing no light of her  
owne, she is lyghtened of the sunne, as manifestly appea-  
reth hereby, that being in consunccion with the sunne, or  
neare vnto him, we see her not lightened, because the  
lyght whiche she then receaueth, is onely by her vpper-  
moste or hyghest parte, wherby she directly beholdeth the  
sunne,

The sunne  
and moone are  
the principall  
luminaries.

The Epicycle  
of the moone.

The consun-  
ction of the  
moone with  
the sunne.

The moone re-  
ceaueth her  
light of the  
sunne.

Sunne, for as muche as he is in the fourth heauen, and the in the first. And departing from the sunne by her proper mooung, the Sunne remaineth on the West parte.

The aspect of the moone to the sunne.

Then towarde that parte we begynne to see a litle of the parte of the moone lyghtened; and so more and more by litle and litle, as she departeth further from the sunne.

The increasynge and opposition of the moone.

And at this tyme she hath her hornes or corners toward the East, because the sunne is in the West. During this tyme also, she is saide to increase, or that she goeth increasynge vnto the opposition whiche we see by the part of her, whiche the sunne directly beholdeth: and so doo we see her altogether lyghtened, and call it the full moone. Then passing from the opposition, she cometh nearer the sunne by litle and litle, beynge darkened and hydd from vs, and lyghtened onely by her hyghest parte, and this tyme is called the decreasynge or wane of the moone, then also hath she her hornes toward the West, because the Sunne is in the East, and this, vntill she turne agayne in coniunction with the sunne, and then we see her not lyghtened at all.

The bygnesse of the moone.

The moone is lesse then the starres, or other planettes, except Mercure, and lesse then the earth: and if anye shall affirme the contrary, saying, that it is wrytten in the first of Genesis, that God made two great lyghtes: the greater, to geue lyght to the day, and the lesse, to lyghten the nyght (as Dauid also affirmeth :) So this I aunswere, that the moone being nearest vnto the earth, appeareth vnto vs greater then she should do, yf she were further distant from vs. And although she be greates of lyght, (recreaued as we haue sayde) and bygge of bodye, yet is she not greates in respect of the other starres, and therefore the wordes of Genesis also false, maye be vnderstoode to be spoken in such manner and phrase as holys scripture often vseth, to humble and applye it selfe to the weaknesse of our vnderstandynge, and grossenesse of our senses.

The moone is nearest vnto the earth.

The .vi. Chapter, of the coniunctions and oppositions of the sunne and the moone.

The



The Sunne and the Moone are moued vnder the Zodiac, with diuers motions. The Moone with a swifter motion then the Sunne, soloweth hym, ouertaketh hym, and goeth before hym, vntyl the place her selfe Diametrally opposite with hym. And

The motion of the moone.

73.11.14.15

When she hath thus ouertaken hym, so that they are both in one selfe same degree of the Zodiacke, then is the conjunction. Then departing from hym, and being in equall degrees of the signes Diametrally opposite, is the opposition. To knowe the tymes of these conjunctions and oppositions, is very profitable and necessary for Partners. These tymes maye be knowen in two manners. One way by the Ephemerides, or Almanackes, or other tables, or Lunary Instrumentes, and by these meanes is knowen precisely the day, houre, and minute of the conjunction and opposition. It may likewise be knowen by the rules of computation, which are the rules which are knowen by memorie, although not precisely, as by the bookes aforesayde. And here is to be vnderstode, that from one conjunction to another, accordyng to the mydde mouynges of the Sunne and the Moone, there passeth 29. dayes. 12. houres, and. 44. minutes, and consequently from conjunction to opposition, and from opposition to conjunction, the halfe thereof, whiche is. 14. dayes. 18. houres, and. 22. minutes. To knowe these conjunctions by rules of computation, is presupposed to knowe the golden number, and by it, the concurrent or Epact.

The conjunction.

The opposite.

To knowe the tymes of conjunctions

73.11.14.15

73.11.14.15

The golden number, is the number of 19. yeeres. In whiche tyme, the conjunctions of the Sunne & the Moone make all their varieties in the tyme of euery yeere. So that yf the conjunction were the 12. day of Marche in this yeere of 1545. from this yeere in 19. yeeres solowynge, whiche shalbe in the yeere of 1564. the conjunction shal retourne to be at the 12. day of Marche. It was firste called the golden nuber by the Egyptians, who wrote founde the vnder thereof, & sent it to Rome writte in golden letters. To finde this nuber, it is needful to know his rootes, which is this.

To knowe the golden number.

The rooten of  
the golden  
number.

In the yeere that Christe our Lorde and redeemer was bozne (whereby we make this account) the golden number was the number of one, which was the yeere of the roote or beginning, and the fyrst yeere of the birth of Christe was two of the golden number. So that sayning to the yeeres of our Lorde, one of the roote or beginning, and from all take away the 19. then the reste shalbe the golden number, and yf you desyre to make computation by a neater roote, take for the roote, the yeere of 1500. when 19. was the golden number: and in the yeere of 1501. dyd begyn one, of the golden number, and so consequently ever taking away the 19.

This present yeere of 1545. we haue .7. of the golden number. And in the yeere of 1546. we shall haue .8. etc.

The concurrent.

The golden number being knowne, it is necessary for this computation of the Moone, to knowe the concurrent. The concurrent of every yeere, is the number of the dayes passed of the conjunction of the Moone at the beginning of Marche. And these growe of the difference of the Solar yeere to the Lunar: as the Lunar yeere hath 354. dayes, and the Solar yeere 365. so hauing every yeere .n. dayes, of difference, which are added every yeere, vntill they come to the number of 30. and passing 30. those that do passe are of the concurrent.

The Solar &  
Lunar yeeres.

To fynde the  
numbre of the  
concurrent.

The number of the concurrent of every yeere, is founde in this maner:

And the better to beare it in memorie, you muste imagine three places, and these commonlye are assigned on the thumbe, as the fyrste place at the roote of the thumbe, the seconde in the myddle ioynte thereof, and the thyrde and last, in the top of the thumbe. When in the fyrst place put 10. in the seconde 20. and in the thyrde 30. When by the order of these places shalbe counted the golden number: as one in the fyrst place, two in the seconde, and three in the thyrde, returninge foure to the fyrst place. etc. vntill the golden number of that yeere, for the whiche the concurrent is sought. And the number of that place where the golden number endeth, muste be sayned with the number of the golden number: and that doth amount

amount therof, shalbe the concurrent, so that it passe not 30. But if it passe. 30. then that that is moze then. 30. is the concurrent of that yeeze.

And here is to be noted, that the yeezes for this computation of the moone, beginne at the first day of Marche, and last vntyll the laste day of February, so that this present yere of. 1545. by computation of the golden number, we haue seuen: whiche accompted by the sayde places, endeth in the firste, whiche is. 10. whiche also ioyned with the golden number of seuen, make 17. and so muche is the concurrent of this present yeeze.

Epacte.

Lykelwyse, this number of Epacte, or concurrent, is founde in multiplying the golden number by. 11. and diuiding the summe by. 30. then that remayneth, is the Epact or concurrent.

To knowe the dayes or age of the moone.

The concurrent being thus knowen, then to knowe the dayes of the moone, it is necessarie to knowe three numbers. The firste, is the concurrent: The seconde, the number of the moneth in whiche you are, beginning at Marche: The thirde, the dayes passe of the same moneth. And ioyning these three numbers, yf they come not to. 30. so many dayes old is the moone. And if they be. 30. it is the conjunction. And if they passe. 30. they also that passe, are the age of the moone.

This is vnderstoode in the monethes that haue. 31. dayes, for in them that haue onely. 30. dayes, the conjunction is at the. 29. day, and they that passe of. 29. are the age of the moone. As for example. The firste day of August, of the concurrent. 17. Of monethes from Marche 6. and of dayes of the moneth. 1. make. 24. and so muche is the age of the moone.

An other example. The tenth of September, of concurrent. 17. Of monethes, seuen: of dayes, ten, which are in all. 34. And because that September hath onely. 30. dayes, we must take away. 29. of the. 34. and so reast spue dayes, which are the age of the moone. And in lyke manner shal we geue to February. 29. dayes of the moone.

To knowe the daye of the conjunction.

It foloweth, that the dayes of the moone being knowen, then vnrackonyng or disreckonyng backward,

we

## The seconde part.

for example. The .xx. of July, the moone hath .xii. dayes taken from the .xx. Remayneth .viii. When the eighth day was the coniunction.

The daye of the coniunction is lyke wyse knowen by fornyng the monethes (begynnyng in Marche) with the concurrent, & if they come not to .30. then at so many dayes of that moneth as lacketh of .30. shalbe the coniunction.

### Example.

In August. 6. of the monethes, and .17. of the concurrent, are .23. whiche of .30. lacketh 7. When at the seventh day was the coniunction, and if they passe .30. then taking them that passe, from the number of the dayes whiche the moneth had next before, and then that which remayneth, dooth shew the day of the coniunction. Lyke as the moone of September of the yee. 1546. we shal count the concurrent. 28. of monethes. 7. whiche are .35. When taking awaye the .5. from .30. and one whiche August hath, remayneth 26. and so the .26. of August, of the yee to come of 1546. the moone shal make coniunction.

The .vii. Chapter, of the declaration and vse  
of an instrumente, by the whiche is founde  
the place and declination of the  
Sunne, with the dayes  
and place of the  
Moone.



To knowe the  
place of the  
moone in the  
zodiack, and  
what aspectes  
she hath with  
the sunne.

In the seconde and thirde Chapter, I haue geuen rules to knowe the true place of the sunne, and his declinatio. In this Chapter I will describe an instrument, whereby maye be knowen the declination and place of the sunne, and knowyng by the Chapter passe, the dayes of the Moone, shall also be knowen her place in the Zodiacke, and howe muche of her is lyghtened, and what aspectes she hath with the sunne. This instrument is in square  
fourme,

fourme, and hath by the sides .23. degrees & a halfe, of the which the .23. & a halfe that descend from the midst downeward, is the declination of the South signes: & the other from the midst upward, are the declinations of the North signes. Within this quadrature is described a circle, by the circumference whereof are the .xii. signes & their degrees, ioyned to the circumference: and further within, is the number of them, and then they names. Yet further within this, is another circle, where are the .xii. monethes, with their numbers and dayes.

The description  
of the in-  
strument.

When to the center of this circle are annexed two rundels, whereof the greatest and lowest is called the rundel of the Sunne. This hath an Index or shewer, in which is paynted the Sunne, and in the circumference of it are the dayes of the age of the Moone. In the other circle, in the circumference thereof, is a rounde hoale, representing the Moone: directly from the which, is another Index compassing forth of the circumference of this rundell, in which rundel are all the aspectes which the Moone maketh with the Sunne.

Having described the Instrument, let us declare the vse thereof: which is this.

The vse of the  
instrument to  
finde the true  
place of the  
the Sunne.

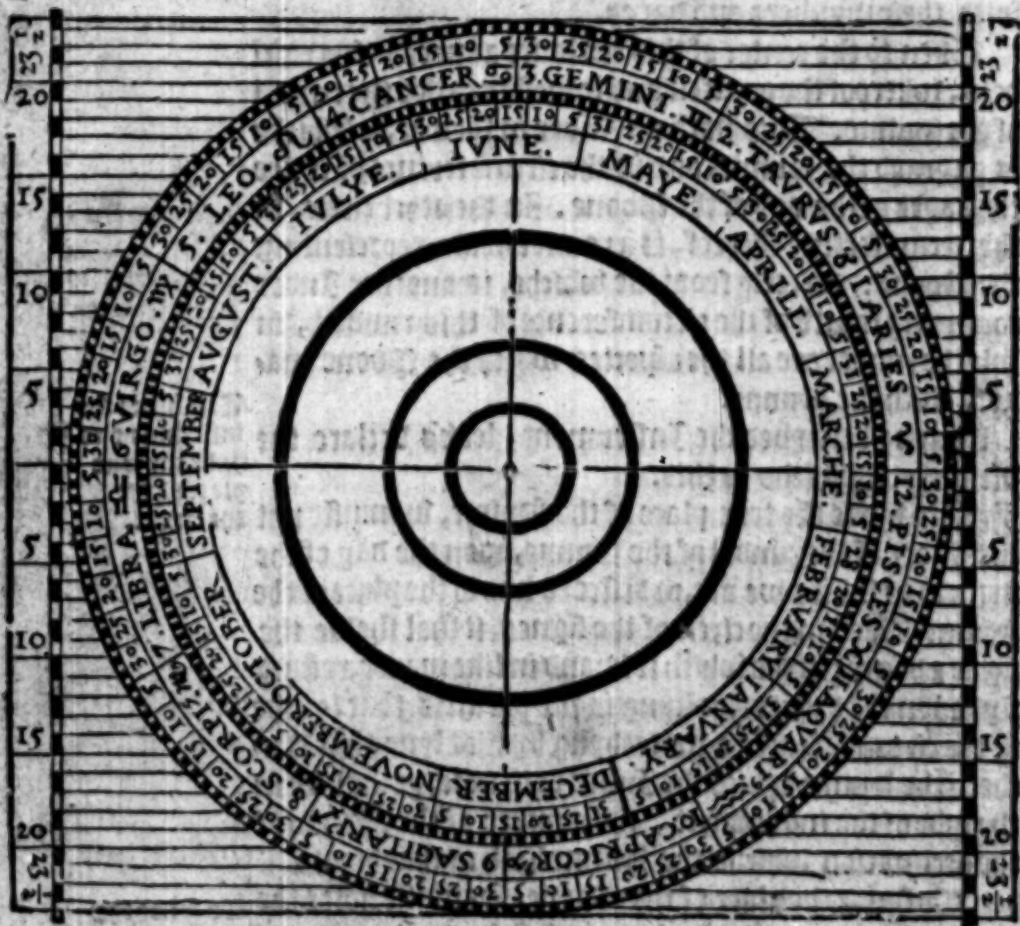
For to fynde the true place of the Sunne, we muste put the Index of the rundel of the Sunne, upon the day of the moneth in which we are, or desire to knowe the place of the Sunne. When in the circle of the signes, it shal shewe the signe & degree in the which it is: and in like manner, resting sylt upon the degree, looking in the parallels that touche in the circumference, & proceeding by that lyne that toucheth the Sunne which the Index doth note, ye shal see in the syde of the instrument, the number of the degrees of the declination which the Sunne hath at that day.

To fynde the place of the Moone, we muste holde the Index of the rundell of the Sunne, fast upon the daye of the moneth in the which we desire to knowe the place of the Moone. And accountyng in the rundell of the Sunne, the dayes that haue passed from the daye of the conjunction (as I haue sayde in the Chapter before) and where endeth that number of the dayes, yf there we

To fynde the  
place of the  
moone.

## The seconde part.

We apply the Index of the Moone, it shall shewe in the circle of the signes, the place where she is. And so shall she appeare in the instrument lyghtened or darkened more or lesse as in heauen. In lyke maner, consydering the place of the Sunne and the Moone, shalbe seene what aspect they haue, by the lynes that trauerse the superficies all of the Lunar circle or circle of the Moone.



The

The aspectes whiche the planettes haue one to another, or whereby they beholde one another, are fyue.

Five aspectes of the planettes.

**Coniunction**, is when two planettes be vnder one selfe same degree and minute in the Zodiack, whose character is this. ☿

Coniunction.

**Opposition** is, when betweene the place of the planettes is halfe a circle, whiche are .180. degrees, and is thus figured. ☿

Opposition.

**Trinall aspecte** is, when betweene the planettes shall be foure signes, whiche are .120. degrees, and is figured thus.

Trinall.

**Quadrine aspecte** is, when one planette is distant from another by thre signes, whiche are .90. degrees, whose character is this. ☐

Quadrine.

**Sextile aspect** is, when two signes are betweene them whiche are .60. degrees, and is marked thus. \*

Sextile.

And yf by memorie you desyre to knowe the true place of the Sunne, without respects of the minutes (whiche may sufficiently be done with the Astrolabe) beare in memorie these numbers .10. 9. 10. 11. 12. 13. 14. 13. 14. 13. 12. Of the whiche, the fyrste serueth for Ianuarie, the seconde for February, with theyr signes: and so of the rest. Then to knowe in what degre the Sunne is, you shall take away the dayes that are applyed to euery moneth, accordyng to the sayde numbers of the dayes, for the whiche you desyre to knowe the true place of the Sunne. And in them that remaine, in so many degrees is the Sunne of the signe into the whiche it entred that moneth. And yf the dayes past of the moneth, shalbe lesse then the dayes applyed to the same moneth: you shall forne .30. with those dayes past of the moneth, and of the summe that amounteth, you shall take away the dayes applyed to the sayd moneth, and the rest shalbe the degrees in whiche the Sunne shalbe of the signe of the moneth past, as for example,

To knowe the place of the Sunne by the rule of memorie.

To knowe in what degre the Sunne is.

Example.

## The second part.

### Example.

January.	10	♊
February.	9	♋
Marche.	10	♌
Apryll.	10	♍
Maye.	11	♎
June.	12	♏
July.	13	♐
August.	14	♑
September.	13	♒
October.	14	♓
November.	13	♈
December.	12	♉

The .22. of October, say-  
 kyng away .14. that were  
 applied, remayne .8. de-  
 gress of Scorpio, where ♏  
 line is. An other example.  
 The .6. of December whi-  
 che are lesser then .12. whi-  
 che is applied vnto it, yf  
 we ioyn .6. to .30. which  
 are the dayes of ♏ moneth  
 next afoze, they make .36.  
 and from them we take a-  
 way the .12. rest .24. So in 24. degrees, is the Sunne,  
 of the signe of the moneth befoze, whiche is Sagittary.

### \* The .viii. Chapter, of the Eclipses of the Moone and the Sunne.



The Eclipses of the Sunne & of the Moone  
 is a thyng that causeth great feare & ad-  
 miration among the common & ignorant  
 people, and to them that vnderstande the  
 cause therof, nothyng at all. And therefore  
 haue I thought good to declare the effectes thereof.

#### The Eclipse of the Moone.

The Eclipse of the Moone, is the interposition of being  
 of the earth betwene her and the Sunne. And where the  
 Moone hath no proper lyght of her owne, and the earth  
 being darke and not transparent, maketh his shadow on  
 the part opposite to the Sunne: the Moone by her pro-  
 per motion doth passe by this shadow, and is Eclipsed or  
 darkened eyther in the whole or in part, accordyng to the  
 portion of her that passeth by the shadowe. Moreover (as  
 we haue sayde) that only the Sunne is moued in the lyne  
 Ecliptike, and the earth being in the center of the world,  
 the point or pyncke of the shadowe shalbe vnder the Eclip-  
 tike. The Moone declineth from the Ecliptik sometymes  
 to the one part & sometymes to the other, because her eccen-  
 trik wherinto she is moued, doth cut the ecliptike equally  
 into two halfe, so that the one halfe of the eccentrik, doth  
 decline fro the ecliptik toward the north part, & the other  
 halfe

#### The motyng of the sunne in the Eclipse.

halfe towarde the South, & the greatest declination of it from the ecliptike, is .5. degrees. In that maner, the moone shalbe at no time in y<sup>e</sup> ecliptike, but only when she shalbe in eyther of the interseccion where the eccentrick doth cut



y<sup>e</sup> said ecliptike. That intersec-  
tion where she passeth & goeth  
toward y<sup>e</sup> North part, is called  
y<sup>e</sup> head of the dragon, & is mar-  
ked thus. ¶ The other where  
she passeth and declineth to-  
ward the South part, is called  
the tale of the Dragon, and  
is marked thus. ¶ And the  
sunne moonyng by his proper  
motion, & coming to y<sup>e</sup> head,  
then shall the shadowe of the  
earth be in the tale, because it  
is the poynt opposite. And yf  
then the moone come thither,  
of her proper motion she pas-  
seth by the shadow, & lackyng  
lyght of the sunne, she is eclipsed.  
And if the sunne come to y<sup>e</sup>  
tale, the shadowe is in the  
head, and then likewise shall y<sup>e</sup>  
moone be eclipsed, yf she passe  
by the head.

It is to vnderstand, that the  
sunne is much bigger then the  
earth, and by perspectiue, the  
shadowe of the earth in holwe  
much y<sup>e</sup> further it parteth from  
it, becommeth sharper & shar-  
per, vntil it come to a poynt: so  
that the shadow of the whole  
earth, is pyramidally sharpe.

And as the moone is lesse then the earth, yet (although his  
shadow goeth sharpning) it suffiseth to eclipse the moone,  
yf she passe by the myddest thereof.

## The seconde parte.

**The eclipse  
of the sunne.**

The Eclipse of the sunne, is the interposition of the moone betwene vs & the sunne, as yf the sunne be in the fourth heauen, and the moone in the first, she being a darke body, and by her proper motion ouertake the sunne, then putting her selfe betwene hym and vs, she couereth him in parte, or in the whole, and this is the Eclipse of the sunne. As the sunne also goeth euer vnder the Ecclyptike, at the tyme that he cometh to the head or tayle of the Dragon, yf then the moone make conjunction with him, shalbe the Eclipse of the sunne, for as muche as they are both vnder the Ecclyptike.

**The eclipse of  
the sunne is  
not vniuersall.**

The Eclipse of the sunne can not be vniuersall in the whole earth, I say, vnto all them that maye see the sunne at the tyme of the Eclipse, as is the Eclipse of the moone vniuersall. For yf the moone haue one parte Ecclypsed, all that maye see her, shall see her ecclypsed: But the sunne some maye see all wholly ecclypsed, and other in parte, or other also not at all ecclypsed: and this all at one selfe same tyme. The cause whereof, is the diuersitie of the aspect, which is to see the moone in the Zodiacke out of her place: as yf the sunne and moone should make conjunction in the begynnyng of Aries, and in the head of the Dragon, they that then shoulde be in the Equinoctiall, vnder the sunne and the moone, or that the sunne and the moone shoulde be in theyr Zenith, they shoulde see the moone hyde all the sunne.

**Howe the sunne  
is ecclypsed in  
the whole, or  
in parte.**

And they that shoulde be in the North Climates, shoulde see, that the moone hydeth or darkeneth onely the South parte of the sunne, and not all. Agayne, they on the South parte, shoulde see the moone hyde the North parte of the sunne, and not all. And yf at the tyme of the conjunction, she haue a lytle passed the head of the Dragon, or lacke a lytle to comme to the tayle, so that she be in the North latitude: they that then shoulde be in the North Climates, shoulde see the moone ecclypse all the sunne: and they of the Equinoctiall shoulde see onely the North parte of the sunne ecclypsed, and they of the South shoulde see him nothing at all ecclypsed. So that  
although

although the Eclipse of the Sunne shalbe totall oꝝ particular, it can not be vniuersall in the whole earth.

And note, that for the quantite of these Eclipses, the Astronomers diuide into xij. equall partes, as well the Diameter of the Sunne, as of the Moone: and these partes they call fingers, punctes, oꝝ pickes, and accoꝝdyng to the punctes of the Diameter of the moone, which is covered by the shadowe of the earth, oꝝ the partes of the Diameter of the Sunne, which the moone doth couer, so many fingers oꝝ punctes shalbe sayde to be Eclipsed. As yf 6 the halfe, yf .3. a quarter, yf .4. a terce, oꝝ thyrde parte, yf .9. three quarters, yf .8. two terces.

It is also to be noted, that although the sunne be bygger then the Moone, yet at some tyme the moone seemeth greater then the Sunne. And this shalbe when the Sunne is in the Auge of the Eccentrike, & the moone in the opposite of the Auge of the Epicycle. And when it so appeareth, he may be all Eclipsed. Sometymes also the moone seemeth lesse. This is when the Sunne is in the opposite of the Auge of the Eccentrike, and the moone in the Auge of the Epicycle. Then although we should see the center of the moone in the center of the Sunne, she can not hyde hym all wholly, because the Sunne shall appeare greater.

Of this that we haue sayde, it foloweth that all the Eclipses of the Sunne, muste of necessitie be in the conuinction. And the Eclipses of the moone, in the opposition: whereby is inferred, that the Eclipse of the Sunne in

Of the quantite of the Eclipses.



why the Moone seemeth somtyme bygger, and somtyme lesse then the Sunne.

The Sunne is Eclipsed in conuinction, and the moone in opposition.

## The second part.

The eclipse of  
the sunne in  
the death of  
Christ.

Howe to see  
the eclipses.

the death of Christ: our redeemer, was not naturall, but miraculous: forasmuche as then was .xv. dayes of the moone, at wiche tyme the moone is at the full, and farre distant from the Sunne, and coude not Eclipse hym. In lyke maner is to be noted, that to see the Eclipses, they of the Sunne must be in the day, and they of the moone in the nyght. And whether the conjunction be in the nyght, or the opposition in the day, the Astronomers make none account.

### ¶ The .ix. Chapter, of tyme, and of the definitions thereof.

Al mouyng is  
in tyme.



As muche as hitherto we haue entreated of the mouinges of the Sunne and of the Moone, and howe all mouyng is in tyme (so that nothing may be moved in an instant or out of time) It shalbe conuenient nowe to declare what thyng Tyme is, and into what partes it is diuided.

What is tyme.

Tyme (as sayth the Philosopher) is a measure of mouyng, acco:dyng to sytse and last, or before and after. Although by accident (as Armandus hath subtilly defined) Tyme may be a measure of rest or quyetnesse: as measures of habites are measures of p:inations. Or Tyme maye be a measure of the mouyng of the sytse moueable called Primum mobile, and cause of generation thereby, and of corruption by accident. Tyme hath the lymittes that hath the worlde, and as the worlde, so is it caused of the mouyng of the heauens, and beganne when GOD created the heauens, and shall ende when the worlde shall haue an ende, as the holy Scholes of the Diuines teache vs. It is assigned to be within the heauens, forasmuche as without them, is neyther tyme, nor any naturall place. All the tyme sence GOD created the worlde, vntyl it shall haue an ende, is called Seculum (that is) a worlde, or an age of Tyme. Albest this worde

Howe tyme is  
cause of gene-  
ration & cor-  
ruption.

The begyn-  
ning and en-  
dyng of tyme.

The place of  
tyme.

Seculum

Seculum in an other sense, maye be extended further then the durabilitie or continuance of the worlde, and this in holy scripture is called *seculum seculi*, that is, the worlde of the worlde: or, *secula seculorum*, whiche is as much to meane, as the worlde, and worlde to come, whiche signifieth eternitie, or everlastyng worlde without ende. Likewise also, *seculum* is taken for the space of a hundred yeeres, whereby in olde tyme certayne playes were called *seculares*, because they were celebrate from a hundred, to a hundred yeeres. The Pope Paule, the thirde of that name, commaunded them to be celebrate in Rome, in the yeere of 1536. whiche was the yeere in the whiche the *seculum* ended, and beganne a newe *seculum*.

And as in tyme are diuers moouynges, so hath it diuers measures, whereof some are greater, and other lesse. The greatest measure of tyme, is a revolution of the heauens, which is slowly mooued, and the principal or cheefe of these, is that that the sunne maketh, whiche we call, a yeere. The lesse measure, is the moouing of the first mouable, whiche moueth moste swiftestly, and this measure we call a day. And for as muche as there is variation in the greatest measures, we wyll in the Chapter folowynge, in treate of the yeere, and of the diuersitie thereof.

Diuers moouynges and measures of tyme.

The .x. Chapter, of the yeere, and of the diuers beginnynges and reckonynges, or computation had thereof in olde tyme.



Here are three differences of the yeere, as the great yeere called (*Annus magnus*) the solar yeere, and the Lunar yeere. The greates yeere is the space of tyme, in the whiche al the planettes returne to the place where they had ben sometime before. As if they al had benne in the begynnyng of Aries, and had begunne their course from thence, and shoulde agayne all returne thither: then shoulde be the greates yeere.

Three differences of yeeres.

The greates yeere.

## The seconde parte.

**The reuolu-  
tion of the  
eight sphere.**

By the description of other, the greate yeere is when the eyngh sphere ioynntly with all the auges, make one perfecte reuolution at the moonyng of the nyenth sphere. And this shalbe in the space of. xlix. thousande yeeres.

**The solar  
yeere.**

The solar yeere, is a reuolution of the sunne, caryed by the proper mouing of his beauen, vpon the aris and poles of the Zodiack, endyng where it beganne, and returning an other yeere by the selfe same course, as the Poet Virgil affirmeth, saying.

Atque in se sua per vestigia voluitur annus.

**Howe the  
Egyptians  
paynted the  
yeere.**

That is to say, The yeere turneth againe to hym selfe by his owne proper steppes.

**The quantitie  
of the yeere**

The Egyptians lacking the vse of letters, and hauing the same consyderation, paynted the yeere lyke vnto an Adder, bytyng her owne taylor: and hereof was a ryng called Annulus, as it were, Annus, (that is a yeere) because a ryng turneth rounde in it selfe as dooth the yeere.

Of the quantitie of this yeere were diuers opinions and computations among them of auncient tyme. The Arabians & Persians accompted it regularly by. xii. moones, whiche are. 354. dayes. Romulus gaue to his yeere. x. monethes, because that time sufficed to a woman to byng forth her byrth, and also for that durynge so muche tyme, it was not lawfull for a wydowe to marrie after the death of her husbände. Pinna Pompius added twi moethes, to make it by twelue monethes in. 350. dayes, whiche

**The yeere of  
the Hebrewes  
The geckes.**

was the mooste auncient yeere of the Hebrewes, accorbyng to the whiche, they accompt at this day. The Grekes and Egyptians consydering the course of the sunne, made the yeere of. 365. dayes: Then by the commaundement of Iulius Caesar, (whose order we nowe obserue) were added. 6. houres, to the ende to make equall this number of dayes with the course of the sunne: and hereof, the bisextile or leape yeere hadde his begynnyng, from foure to foure yeeres. But to say the truth, they erred: The one, by somewhat to much, and the other, by somewhat to lytle.

**Iulius Cae-  
sar**

**Leape yeere.**

**Dayes of the  
yeere.**

The yeere conteyneth 365. dayes. 5. houres, and. 49. minutes.

Lyke.

Lyke wyse, at the firste, the peere hadde diuers begyn-  
nynges, Bruma Pompilius beganne it from the Wynter  
Solstitiall, because that then the sunne begynneth to ryse  
towards vs, as Duide affirmeth in these verses.

Beginning  
of the peere.

Duide.

Bruma noui prima est, veterisque nouissima Solis;  
Principium capiunt Phebus & Annus idem.

Bruma is  
the stay of the  
Sunne in  
Wynter, the  
wynter solsti-  
tiall, and the  
first day of the  
peere.

Whiche may thus be englished.

Wynter is the first of the newe peere,  
And last day of the olde:  
The sunne and peere begynne at once,  
As Duide hath vs tolde.

Romulus began it in Marche, at the Equinox of the  
spryng, because that then all thynges reuiue and flourish:  
and by the opinion of the Diuines, it seemeth good reason  
to begynne the peere at Marche, because the worlde was  
created the .25. of the kalendes of Aprill, whiche is the .18.  
of the moneth aforesayde. Lyke wyse, God speakyng of  
this moneth to the people of Israel, sayde vnto them,  
This shalbe the firste of the monethes of the peere. The  
Arabians begynne from the Sommer solstitiall, whose  
opinion is, that the sunne was made in the signe of Leo.  
Other begynne the peere in September, about the Equi-  
noctiall of Autumne, as doo the Jewes, reasynyng in the  
auctoritie of Genesis, where is wyrtten thus: Let the  
earth bryng forth greene hearbes, to haue fruite agree-  
able to theyr kynde. &c And because Autumne is a fruit-  
full tyme, they began from thence to accompt these peere.  
The Grekes, Persians, and Egyptians, accompted it  
from October. The Christians, some from the incarnati-  
on of Christe: other, from his birth, and other, from the  
firste day of Januarie.

The creation  
of the worlde.  
Exodus. xi.

where Christ  
is sayng beginn-  
ing the peere.

In lyke manner, is greete diuersitie in begynnyng the  
number of peeres, whiche we call Era, that is, the date.  
The Grekes beganne theyr date from the death of  
greate Alexander. The Egyptians, from the death of  
Pabu.

Diuerse  
the number of  
peeres, or the  
date.

## The second part,

**P**abuchodonosor: the Persians, from Celsargit: the Arabians or Moores, from the preaching of Pachomet, who was after the byrth of Christe. 626. yeeres: Other also, from the Romane Emperours. The Christians beganne the accompte of our Saviour Iesu Christe. 500. yeeres after his byrth, as wyrteth Cardinall Cusanus, and here it shall not be from my purpose, to shewe howe iustlye and rightfully was comaunded by Don John king of Spaine, the firste of that name, that in the courtes and parliaments whiche he helde in Segouia, in the yeere of. 1383. leauyng the dates that they had begonne from the Emperour Octauian, for tributes and other paymentes specified in wyrtyngs and priuileges, they shoulde no moze put the date of the Emperour, for as muche as the day in the whiche the sonne of God became man, and was bozne of the blessed Virgin, was so excellent a thyng, and mooste woorthy to be had in memorie. So that in Spayne, since that time, in al common wyrtynge, the date is made from the Natyuitie of our Lords, begynnyng there the first day of the yeere, & commonly the first day of January, Some Astronomers begynne it the first of Marche.

We haue in this Chapter intreated of the great yeere, and of the Solar yeere, with his quantitie, begynnyng, and date. In the Chapter folowing, we wyll entreate of the Lunar yeere, whiche we cal a moneth.

### The.xi. Chapter, of the moneth, and of his differences.

**T**he Lunar yeere or moneth.

**R**evolution of the moone.



**C**onsideryng the moneth absolutely, without hannyng respects to the Solar yeere, it maye be called a yeere, accordyng to the diuision we haue made in the Chapter of the yeere. For it is a revolution of the heauen of the moone, whiche moueth slowly in comparison to the firste heauen. And yf we

We consider the moneth as part of the yeere, then is the name of a moneth more proper vnto it. For this word Mens mensis in Latin, is deriued of Mensura, which signifieth measure. And so the moneth and yeere referred to tyme, all may be called moneth: soasmuch as all is the measure of tyme, as we haue touched in the sayde Chapter of the yeere.

The moneth is to be considered in two maners: either as it is parte of the Solar yeere, or is caused by the course of the Moone. The moneth that is parte of the Solar yeere, is that whiche at this day we vse. And into xii. of these monethes, is the yeere diuided: as January, February, March, Aprill, May, Iune, Iuly, August, September, October, November, December.

They are not all of equall dayes, Aprill, Iune, September, and November, haue .30. dayes: all the other haue .31. except February, which hath .28. and when the bisertile, or leape is, it hath .29. The names and numbers of these monethes were assigned at the wyll and pleasure of men, and the cause why they haue remayned so long tyme, is the auctoritie of the Emperours, that ordeyned them for the common people, who accepted them by the Romane Church which admitted the vse of them.

The Lunar moneth hath two considerations. The one is the tyme which the Moone tarreth from that she cometh forth from one punct of the Zodiack, vntill she returne thither by her proper mouyng. And this is called the moneth of the peragratiō: in which reuolutiō she spendeth .27. dayes, and almost .8. houres. The other consideration is, hauyng respect to the tyme whiche the moone tarreth, from that she is in coniunction with the Sunne, vntill an other coniunction. And this is called the moneth of consecutiō; and is more then the moneth of peragratiō, by two dayes .4. houres .44. minutes. For the Sunne and the moone beyng in coniunction vnder one punct of the Zodiacke, and mouyng both by theyr proper mouynges towarde the East, as the mouyng of the moone is swifter then the mouyng of the Sunne, she leaueth hym behynde.

The diuision  
of the yeere  
into xii. monethes

The Lunar  
moneth.

The month of  
peragratiō.

The moneth  
of consecutiō.

The mouyng  
of the Sunne  
and Moone in  
coniunctiō.

And

## The second part.

And when she hath ended her moneth of peragratiō: she returneth to the poynt from whence she departed: and not syding the Sunne there (because in the meane tyme the Sonne of his proper motion hath gone almoste 27. degrees) the Moone passeth from this poynt: and in the sayde .2. dayes .4. houres .44. minutes, ouertaketh the Sunne: and so commonly hath this moneth of consecution. 29. dayes .12. houres and 44. minutes.

So that what soeuer is sayde of the Lunar moneth, is to be vnderstode of this moneth of consecution, whiche all they vse that account by Moones: as do the Hebrewes, Arabians, and Persians.

To know the  
tydes by the  
aspectes of  
the Moone.

The Mariners ought not to neglect this computation, because it is conuenient for them to knowe the tydes, and other effectes caused by the aspectes of the Sunne and the Moone, for they aspectes do correspond to the partes of this moneth, as the coniunction to the begynnyng, the opposition to the myddest, and the quartyle aspect to the quarter, and so of the other. Likewyse in this moneth, is considered the illumination of the Moone, and the dayes that the light sayeth her: so that neyther by day nor by night we may see her, for being burnt vnder the beames of the sunne. The tyme that she is so, is called Interlunium

The illumi-  
nation or  
change of the  
Moone.

(that is) the chaunge of bydyng, whiche is sometyme more, and sometyme lesse. When the coniunction shalbe from the begynnyng of Capricorne vntyl the ende of Gemini, and the Moone hath North latitude, and her moving swyft: then shal the newe moone soone be seene, and so shal the Interlunium be but lytle. And when the coniunction shalbe from the begynnyng of Cancer, vntyl the ende of Sagittarius, and the moone hath South latitude, and her moving slowe: the longer wyll it be or the newe moone shewe her selfe to vs. And certayne of

Interlunium,  
is the space of  
tyme in the  
which neither  
the old Moone  
both appeare,  
nor the newe  
Moone is  
seene.

these causes concurring and not all, so

shall the Interlunium be in a  
meane betwene both.

¶ The

## The. xii. Chapter, of the weeke.



The weeke is a tyme of seuen dayes, the begynnyng wherof, is Sunday, and so did the Jewes counte theyr firste day, saying, Prima sabati, Secunda sabati, (that is) the first of the sabboth, the seconde of the sabboth, &c. to the fyrth of the Sabboth, and then y sabboth. The Romanes

The weeke  
of the Jewes,

The Romanes

that called the planettes, Gods, for as much as the sunne was principal among them, called their first day, y day of the sunne, the seconde, of the moone, the thirde, of Mars, the fourth, of Mercury, the fift, of Jupiter, the syrth, of Venus, the seventh, of Saturne. The Christians solemnizing the Sunday, beganne theyr accompte from it: as, on suche a day our Lorde was borne: or such a day he rose: and on such a day he sent the holy ghost vpon his apostles, &c. They also accompt the dayes of the weeke for Ferias,

The Christians

Ferias, signifieth vacant dayes, or some tyme holy or festiual dayes.

## The. xiii. Chapter, of the day, and of the nyght.



The day is of two sortes, as, the natural day, and the artificial day. The natural day, is the space of tyme, wherin the sunne is caried by y first moueable about the earth, from the Perisian to the Tread, & from the Tread vnder the earth, comming to the East, and

The natural day.

from thence retournyng agayne to the saide Perisian: and this tyme hath the Equinoctiall geuen one whole tyme, & more, suche parte of it as correspondeth to the proper moouing of the sunne: or other wyse, the natural day is a circle described with the center of the sunne, at the moouing of the first moueable. The Romanes beganne this natural day, from mydnyght, and ended it in the mydnyght foloweng, and so doo we accompte it for sayng dayes:

The begynnyng of the natural day.

and

and from euening to euening, in celebrating of festiual  
 dayes. The Athenienses beganne it at the sunne set, or  
 goyng downe of the sunne. The Babylonians, at the ry-  
 syng of the sunne. The Ambzians, and Ethuscos, from  
 the mdday, or noone, and ended it the noone day folow-  
 yng. In this manner doo the Astronomers begynne it,  
 and find that the day shall ener begynne at one selfe same  
 houre for the equalitie of the meridians. And if they had  
 begunne it from the rysing or fall of the sunne, it shoulde  
 not be cuer at one selfe same houre, because the sunne ry-  
 seth and falleth at sometymes sooner, and at other tymes  
 later: and so shoulde the beginning of the day be variable.  
 And it is to vnderstande, that when we commonly say, at  
 the tenth day of suche a moneth: the same tenth day dooth  
 ende the same day at noone, and the houres that runne  
 from that noonetyde forwarde, are of the eleuenth day:  
 and so doo the Astronomers accompt them.

The ende of  
 natural day.

The artificial  
 day.

The nyght.

The day artificial, is part of the day naturall, & is the  
 time that the sunne tarieth from that it riseth in the East,  
 vntil it fall in the West. And the nyght is that part that  
 lacketh or sayleth for the naturall day, whiche is the tyme  
 that the sunne tarpeth from that he hideth him selfe in the  
 West, vntil he returne to appeare in the East: and so the  
 day artificiall and the nyght, make one naturall day. And  
 accordyng hereunto, it is wyrtten in Genesis, that of eue-  
 ning and morning was made one day. Iodorus defining  
 this artificiall day, sayth, that the day is the presence of  
 the sunne, or the beyng of the sunne aboue the earth: as it  
 is nyght vnto vs when he is vnder it. Or other wyse, the  
 nyght is the shadowe of the earth, extended diametrally  
 opposite to the sunne. The quantitie and differences of  
 these dayes artificiall, and theyr nightes, and howe they  
 increase and diminishe, we haue largely declared in the  
 sixte Chapter.

The

## The .xliii Chapter, of houres.



As there is two differences of the daye,  
as the naturall daye, and artificiall: so  
is there two differences of houres, as  
houres naturall whiche corresponde to  
the naturall daye, and houres artifi-  
ciall, whitch correspond to the artificiall  
daye. Hora or Ora is a Greeke  
name, and signifieth ende. And so saye  
we Ora maris, for the ende of bymme of the sea, or the  
lyste or edge of apparel, as sayth Isidore in his Etimo-  
logies. The houre naturall or equall, is a .24. part of the  
day naturall: and is the tyme of passyng .15. degrees of the  
Equinoctial. These .24. houres that make one natural  
day, the Astronomers doth begin the day at the Meridian,  
compting the houres after the order of the syzle moue-  
ble, whiche is from the sayde Meridian, proceeding to-  
warde the West, and from them to the Meridian in the  
angle of mydnyght, where they accompt .12. houres, and  
from thence towarde the East, and come to ende the .24.  
houres in the same Meridian where they began: this they  
vse for the computation of the tables of the mouynges  
of the heauens. The Astronomers vse the same in theyr  
instrumentes, as in the Astrolabe, and Dyalles Ho-  
rizontall and verticall, and in all other instrumentes for  
houres. In Spaine also we vse to accompt these .24. in  
two tymes twelue, beginning at noone, and ending  
xij at mydnyght: and agayne, beginning at mydnyght,  
and ending other twelue at noone. And to distyncte the  
one from the other, they call the one after noone houres,  
and the other forenoone houres: and commonly we saye  
syre houres of the moynyng, and syre of the euenyng. In  
Italy they accompt them from the falling of the Sunne,  
butt the next fall the day folowynge.

The artificiall or temperall houre, is a twelfth part of  
the day arch or the nyght arch.

Houres natu-  
rall and artifi-  
ciall.

The houre na-  
turall or equall

The houre  
artificiall or  
temperal.

They

The day and  
nyght divided  
into foure  
partes.

Interpretati-  
on of certayne  
places of the  
Gospel.

The nyght di-  
uided into  
foure quar-  
ters.

Foure wat-  
ches of the  
nyght.

They are called temperall houres, because they varpe in the tymes that the day varyeth. For in the tyme that the dayes shalbe great, so shalbe the houres. And when the dayes shalbe shorte, so lykelysse shall the houres be, and in lyke manner of the nyghtes. So that, as the artificer, all day great or lytle, is divided into other .12. houres, even so the nyght great or lytle, is divided into other .12. The auncientes divided the daye into foure partes, and the nyght into other foure, geuyng vnto euery quarter part three houres. At the ryng of the Sunne, which was the fyrste houre of the fyrste quarter, they called the fyrste houre; and three houres passed, they called the thyrd houre, and fyve houres passed of the daye, they called the fyrst houre, which was the mydday or noone tyme. Also the nyynth houre, they named at nyne houres paste of the day. And the Sunne sette, or goyng downe of the Sunne, they called the Cuenyng: as sayth the Poet Virgill in this bearse.

Ante diem clause componet vesper Olimpo. And accordyng to this computation, is to be understood that wyrteth Saint Mathewe: That the labourers came to the Vineyarde at the eleventh houre, wherby is meant the fift houre, one houre before the Sunne was set. And when we reade in saint Iohn: The ague sette hym the twelfth houre. &c. By this account it was one houre after noone, when Christe healed the sonne of the vnder that was diseased in Capernaum. In lyke manner by these houres the auncientes divided the nyght into foure quarters, geuyng three houres to euery quarter. And in these foure partes of the nyght were souldiers appoynted to watche. In the fyrst quarter which they call Cancicinium (and we the fyrst sleepe) they watched all. In the seconde, which they called Intempetium, beyng the turne of myddnyght, the young men watched. In the third, which they called Gallicinium, of the crowing of the Cocks, watched the souldiers of myddle age. In the fourth & last quarter, called Matutinium or Antilocaniz (that is, the spring of the day) the olde souldiers watched. And thus is understood the fyrst, the seconde, and the thyrde watche.

watche of the nyght. In lyke maner ought the Partners to keepe watche and warde, to auoyde aswell the peryll of the Sea, as also the daungers of Honers: and to dwelde the nyght by quarters after the maner of souldiers, as dyd also the Partners in olde tyme.

Howe mariners ought to watche.

♦ The .xv. Chapter, of the making and vse of a vniuersall Diall for the day.



Here as in the Chapter before, we haue entreated of houres and theyr differences, we entende here to describe the making of an instrument generall, to knowe the houres of the day by the beames of the sunne: whiche is donne in this manner. Take a round plate of laton, and let it be called the Equinoctiall circle: the circumference wherof, you shall diuide into .24. equall partes by both the sydes, and from the center to euery of these partes, you shall drawe a ryght lyne: one of the whiche, shalbe a Peridian. And in the one part of that, wyte .xii. whiche shalbe the houre of the mydday or noone. And in the other parte, wyte other .xii. whiche shalbe for mydnyght. In the vpper part, turning vpon the center, towarde the ryght hande, wyte, one, two, thre, foure, &c. In the lower, or neather part, you shall count towarde the left hande, turning it vppon the center: so that the one houre of the one part, come vppon the lyne of the one houre of the other part, in lyke maner two vppon two, thre vppon thre, and so fourth of the other. And note that in the lyne of syre at after noone, and at the lyne of syre in the mornynge, there remaine certayne round peeces, corners, or endes, after the maner of aris, of the thickenesse of the selfe same plate. When make a halfe circle of the same metall as bygge as the halfe circumference of the plate, and of the thickenesse of a peece of .iiii. ryals of plate, or some what more, such as the plate it selfe, and of the breadth of halfe a

To know the houres of the day by the sunne.

## The second part.

fynger if the instrument shalbe great, or lesse if the instrument shalbe lesse. This halfe circle, shall you graduate or diuide into .180. degrees, begynnynge at the one ende, one, two, thre, and so forth vnto .90. in the myddest, and the lyke shall you doo from the other ende vnto the same. 90. Also you muste number them in the breadth of the same halfe cyrcle: and this halfe circle, shall you make fast on the neather part of the instrument, so that the endes thereof may be fyred in the endes of the Peridian lyne. Then through the center of the plate or Equinoctiall circle, shall passe a round Steele or wyre of the same metall, made faste or lothered in it, so that it ryse and come forth equally from euery syde of the plate the fourth parte of the Diameter of the same, and this shalbe called the Axis or axistree of the worlde. The instrument being thus made, you shal place it or set it in a frame, hauynge two armes, standardes, or arches, so that it change betwene the sayde arches, bothe by by the rounde peeces or endes of the plate left thereof at the endes of the lyne of the fyre houres aforesayde, in suche sort, that being thus stayed, it may be directly turned. And in the myddest betwene these two armes, beneath in the foote of them, or where they are placed, you shall reyse a pycke, or poynt: so that the plate which signifieth the Equinoctiall, being perpendicular, the bynne or edge thereof may fall vpon the poynt or pycke, and consequently the plate standynge playne or flat, the .90. degrees of the halfe circle, must shewe or touche the sayde pycke, as shall also the ende or extremitie of the Axis of the worlde, and the other ende shall shewe the Zenith or verticall poynt.

**The placing of the instrument.**

**The syndynge of the meridian lyne.**

This instrument muste be so placed, that the Peridian lyne be North and South: whiche you shall fynde in this maner. In an open and playne place where the Sunne shyneth for the moste part of the daye, you shall make a circle with a payre of compasses, in the myddest whercof, you shall set a Steele or wyre, so bypyght that it declyne not or bende not, eyther one way or an other, and the same no longer then the fourth parte of the Diameter of the circle. Then in the moornyng when the Sunne riseth, the shadowe

Shadowe shalbe very long, and as it yseth hygher and  
hygher, so the shadowe wareth shorter and shorter. Then  
muske you obserue the tyme when the extremitie or end of  
the shadowe toucheth in the circumference of the circle,  
and where it toucheth, you shall make a prycke: Then go-  
eth the shadowe shortning vnto the midday or noone tide,  
and as from thence the sunne declineth, so dooth the sha-  
dow encrease, and when it shall comme agayne to the cir-  
cumference of the circle, you shall make an other prycke.  
Then shall you parte in the myddest, the arke that is be-  
tweene the one prycke and the other, and from the myddle  
prycke, drawe a ryght lyne to the center of the circle: And  
that shalbe the Meridian lyne, whereupon you shal set the  
instrument. Furthermoze, in the foote of the frame of  
the instrument, you shal set a compasse or dyall, which shal  
shewe the Meridian lyne. This donne, hypon the arches  
of the frame, and corners of the sixe houres, you shal turne  
the Equinoctiall so farre, that it passe so muche of the  
halfe circle by the myddle prycke, how many degrees

the Pole is rayled aboue the Horizon of that

Region or place where you are, and then

the shadowe of the wyze or stile, shall

justly shewe in the plate, the

houre, and what a clocke

it is.

The elevation  
of the pole.

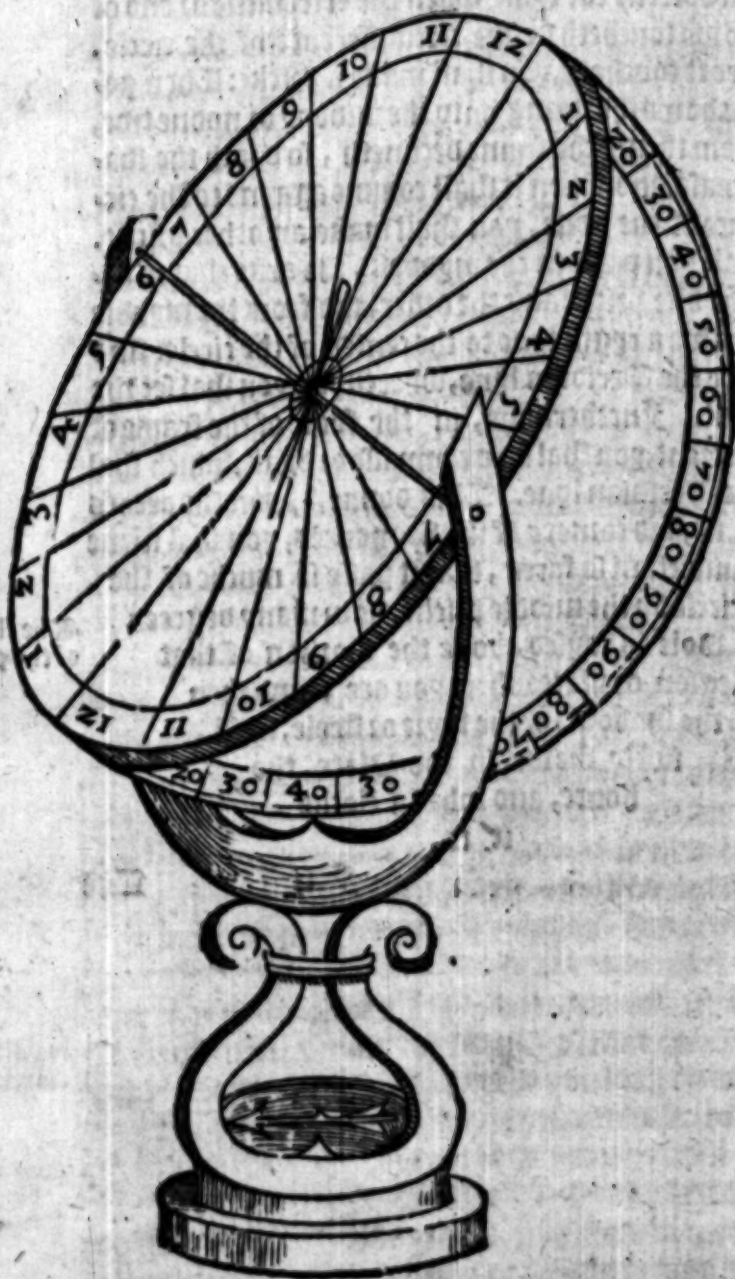
F II

The



The seconde parte.

¶ Here foloweth the figure of the  
Instrument.



¶ The.xvi. Chapter, of certayne particuler  
Dyals, Parall, and Horizontall.



Among sundry maners and fashions of  
particuler Dyals, there are two princi-  
pall. Wherof the one is Horizontall,  
whiche is placed in the superficiall of  
the Horizon, the other is vertical, and  
must be made or set on a walles perpen-  
dicular, and directly agaynst the south  
or myddaye, from the poynt of the true

Dyals Horiz-  
zontall and  
vertical.

leuant or East, to the true poynt or West, the whiche the  
Mariners call East and West. To make any of these East and west  
two Dyals, you must drawe a ryght lyne, and call it the  
Axis of the poles of the worlde, vpon the whiche you  
shall drawe an halfe circle, and diuide it in 90. equall  
parts. And where the half circle is cut with the lyne of the  
Axis, muste be accounted by the circumference, the alti-  
tude of the pole for the title or place for the whiche you in-  
tende to make the Dyall. And in the poynt of the circum-  
ference where endeth the altitude of the pole, you shall  
make a marke, and wypte there. The altitude of the pole.  
And from that poynt drawe a ryght lyne vnto the poynt  
wher'son beganne to account the altitude of the pole,  
whiche lyne shalbe called the Semidiameter, or halfe Di-  
ameter of the vertical circle. And from the same poynt  
of the altitude of the pole, drawe another ryght lyne to  
the other extremitie or ende of the Axis, and this shalbe  
called the Semidiameter of the Horizon, and lyke wyse  
from the same poynt of the altitude of the pole, drawe a  
ryght lyne perpendicular vntill it touche in the Axis, and  
this shalbe called the Semidiameter of the Equinoctiall.  
Whereby is considered a Triangle whiche hath by the  
sydes thereof, the Semidiameter of the vertical, the Se-  
midiameter of the Horizon, and the axis of the worlde, The triangle,  
whiche Triangle shall serue afterwarde. These three Se-  
midiameters, of the vertical, the Equinoctiall, and the  
Horizon, beynge founde, you shall make the Dyall in this  
maner.

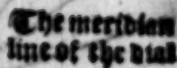
## The seconde parte.

The making  
of the Diall.

Drawe a ryght lyne, somewhat long, & cal it the lyne of  
contingence. This shal you cut with an other line in right  
angles, after the maner of a crosse, which shalbe the Meri-  
dian lyne. Then with your compasse, take from the tri-  
angle the Semidiameter of the Equinoctial, and of this  
bygnasse, drawe a circle vpon the meridian lyne: so that  
the edge or bypasse of the circle, touche in the lyne of con-  
tingence. Then with a compasse, take the Diameter of the  
verticall circle, yf you wyll make a murall Diall, or the  
Semidiameter of the Horizon, yf you wyll make a Hori-  
zontal Diall, on a playne or flat soyme. Therfore with such  
Semidiameter as you desyre, you shal drawe a circle vpon  
the other part of the meridian lyne, so that the circumfe-  
rence thereof touche in the lyne of contingence. Then shal  
you diuise the Equinoctial circle into foure equal partes,  
and the quarter that is towarde the lyne of contingence,  
shal you diuise into sixe equal partes. And setting the end  
of the ruler in the center of the Equinoctial, and vpon eue-  
ry poynt of them that diuise the syxe equal partes, from  
thence shal you drawe certayne ryght lynes, vntill they  
touch in the lyne of contingence. And from these poyntes  
of the lyne of contingence, you shal drawe other ryght  
lynes, to the center of the Horizontall circle, which lynes  
shalbe the determiners of the houres. And neare vnto  
the meridian lyne, where it toucheth in the lyne of contin-  
gence, you shal wyte .12. and consequently towarde the  
East, you shal wyte, one, two, thre, foure, fyve, syxe,  
and from this syxth houre, you shal drawe a ryght lyne,  
whiche shal passe by the center of the Horizontall circle e-  
qually distaunt from the lyne of contingence. The one  
quarter of the Horizontall being drawn by the selfe same,  
and of the same measure and byggnesse shal you drawe  
the other, in suche sorte, that the same bygnesse that is  
from twelue, to one, the selfe same shal you geue from the  
twelfth, to the eleventh: and the same bygnesse and mea-  
sure that is from one, to two, shal you geue from .xi. to .xii.,  
and so forth of the other.

And note that the Horizontall Diall, after the first  
houre of the euenyng, shal haue the houres of vii. and viii.  
and

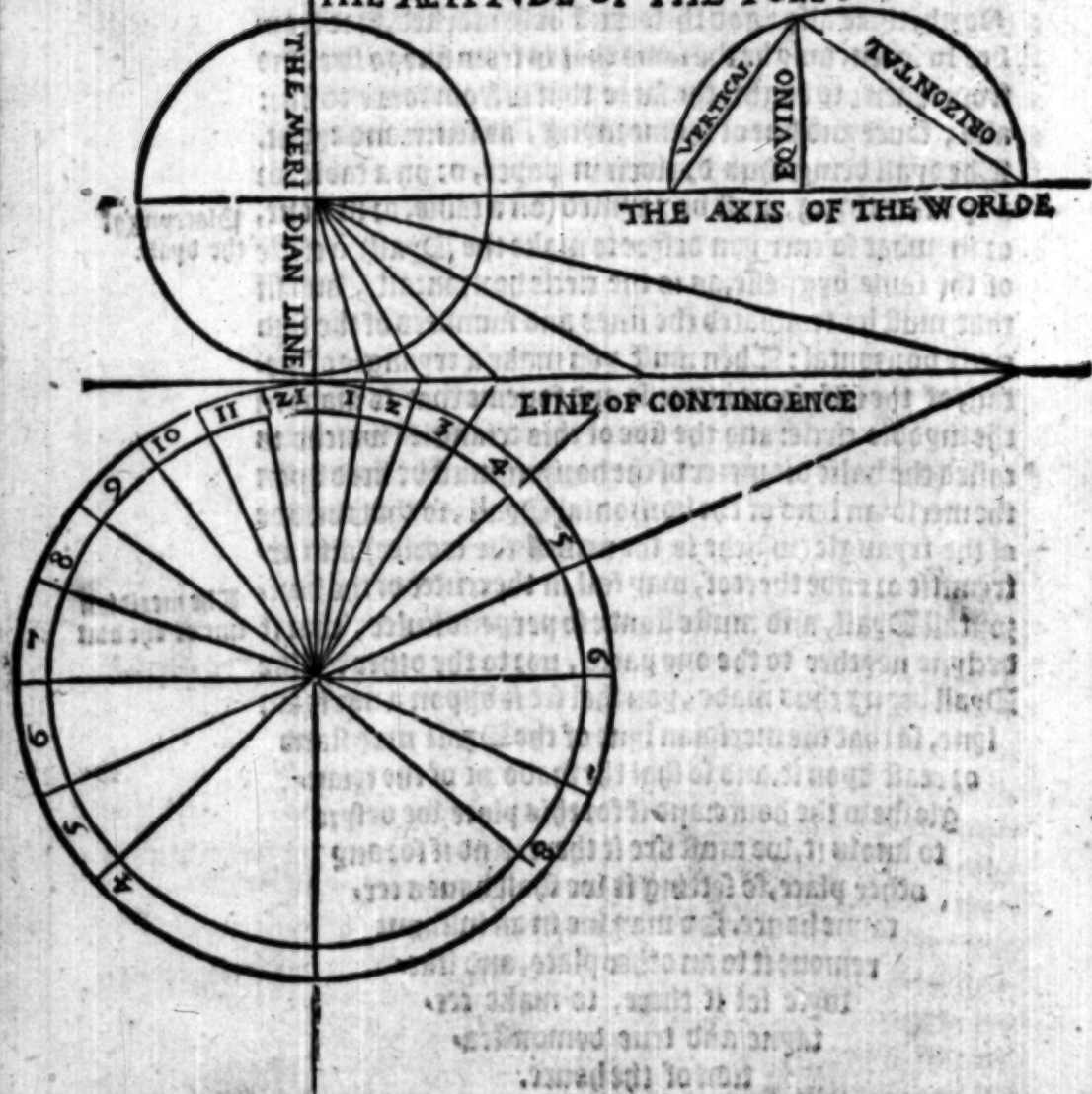
and in climates farre North, & also, and more yf  
 neede shall requyre: and consequently muste haue the hou-  
 res of siue and foure of the morning, and in climates farre  
 South, three also: and these must be so marked, that from  
 siue to seuen, may be the same that is from siue to siue, and  
 from seuen, to eyght, the same that is from foure to siue:  
 also, foure and siue of the morning, as seuen and eyght.  
 The dyall being thus drawen in paper, or on a table, or  
 any other thyng, must be paynted (on a table, or in stone, <sup>Placynge of</sup>  
 or in what so euer you desyre to make the Dyall) a circle <sup>the dyall.</sup>  
 of the same bygnesse, as is the circle horizontall, and in  
 that must be translated the lines and numbers of the said  
 circle horizontall: Then must you make a tryangle of me-  
 tall, of the selfe same bygnesse and fourme that is made in  
 the myddle circle: and the side of this triangle (whiche is  
 called the halfe diameter of the horizon) must be fixed vpon  
 the meridian lyne of the horizontall Dyall, so that the side  
 of the tryangle (whiche is the axis of the world) and ex-  
 tremitie or ende thereof, may fall in the center of the hori-  
 zontall Dyall, and muste stande so perpendiculer, that it  
 declyne neyther to the one parte, nor to the other. The  
 Dyall being thus made, you shal set it vpon a meridian  
 lyne, so that the meridian lyne of the Dyall may stand  
 or reast vpon it, and so shal the shadowe of the trian-  
 gle shew the houre: and if for this place we desyre  
 to know it, we must fixe it there. And if for any  
 other place, so setting it we shall haue a cer-  
 tayne houre. So may we in an instant  
 remoue it to an other place, and like-  
 wyse set it there, to make cer-  
 tayne and true demonstra-  
 tion of the houre.



## The second part,

Here foloweth the figure of this  
demonstration.

THE ALTI TUDE OF THE POLE 37



The making  
of the vertical  
Diall.

In lyke manner, as is made the Horizontall Diall,  
muske be made the verticall, taking from the triangle the  
Semidiameter of the circle verticall.

And note, that for the circle verticall, it shall not be  
needeful of more then sixe houres befoze noone, and other  
syre

seye after noone. And the triangle muste be first in the Per-  
sidian lyne, vppon the side that is called the Semidiameter  
of the circle verticall, and if you wyl not make a tri-  
angle of metall, but that a wyre of Iron maye geue the  
shadoiwe, then must you make the sayde triangle of paste  
or paper, and accordyng to the fourme or paterne thereof,  
make the wyre of iron, and cause the same to be set in all  
soytes of Dialles, as is beforesayde.

**The. xvii. Chapter, of the composition  
and vse of an instrument generall for  
the houres of the nyght.**



Here as in the Chapters past, I haue  
described the manner and forme, to  
make two Dialles for the houres of  
the day, me seemeth that for the more  
perfection of this woork, it should be  
conuenient here to teach y making of  
a dial, to know the houres of the night

by the circle which the two starres, called the **Guardians**, **The Guardians**  
or the mouth of the horne, doo describe by the moouyng of **starres.**  
the first moouable. But for as muche as it is a common  
opinion, that in the myddest of Aprill it is mydnyght  
when the Guardians be in the head, whereof they take the  
beginnyng of the yere, I wyl declare how it ought to be  
vnder stood. Certaynly it is, that to be mydnyght, is none  
other thyng, but the sunne to be by the moouyng of the  
first moouable, to enery one in that parte of his Persidian  
that is to hym vnder the earth, euen as is to him midday,  
or noone, when to hym it is in that parte of the Persidian  
that is aboue the earth. And in this present yere of 1545.  
(to be out of doubt hereof) I made experyence with a pre-  
cise Astrolabe, so that the first or foremoste Guard starre,  
being perpendicularly ouer or aboue the South starre, I  
founde in the meridian, where the sunne maketh myd-  
nyght, the 11. degree of Taurus, wherby it foloweth, that  
the sunne being in this degree, which is at the 11. of  
Aprill, the said Guard starre shalbe perpendicularly ouer

what is myd-  
nyght.

Noone or mid  
day.

In error.

The making  
of the instru-  
ment.

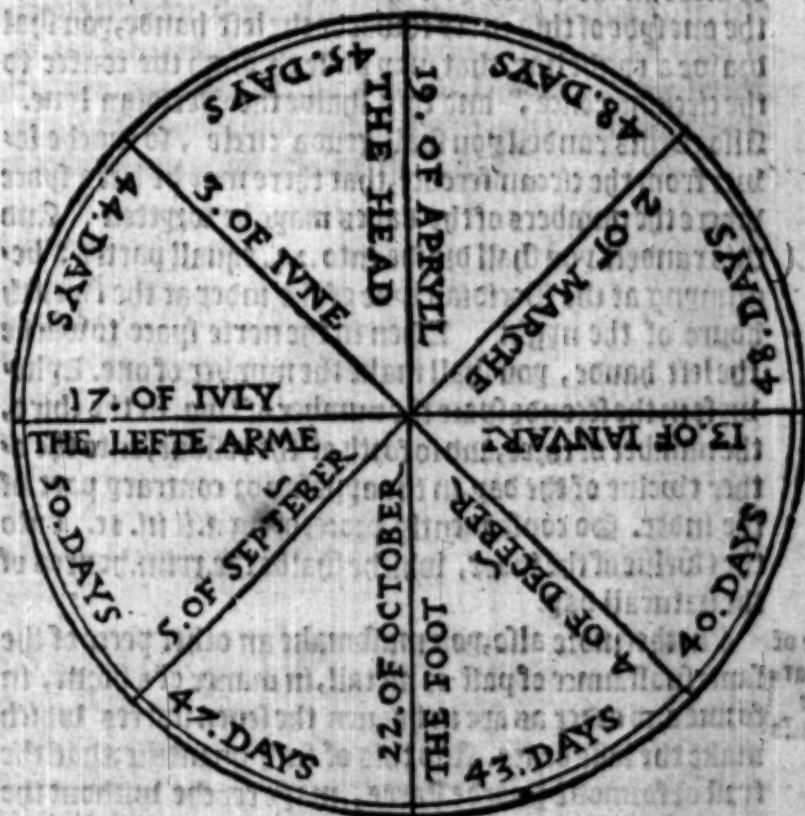
The North Starre, whiche is the lyne of the head, and conse-  
quently the sunne being in the .9. degree of Scorpio, whi-  
che is at the .xii. of October, the guard starre shalbe in the  
lyne of the ferte: and by this calculation may be knowen  
when it shalbe in the ryght arme, or in the leaste, and in al  
the other lyne: so that they manysfully erre, that accompt  
the midnyght at the .xv. of Aprill, when the first guard starre  
is in the lyne of the head, accompting a terte or third part  
of an houre sooner and moze then they shoulde doo.

Maung thus geuen principles for the instrument, you  
shall procede in the making thereof, as foloweth. In  
paste, or on a plate of laton, make a circle of the quanty-  
tie of a spanne, or of the bygnesse that you desyre the in-  
strument or diall to be: then make an other circle some-  
what lesse, so farre disaunt from the greater, that be-  
twene the one and the other may be a space, in the which  
may be signed or marked the dayes and monethes. Lyke-  
wise shall you make an other lesse circle, leauyng space to  
set the numbers of the dayes of euery moneth. And vnder  
this circle, shal you make another, leauyng space to write  
the names of the monethes: then shall you diuide the first  
and greatest circle into eght equall partes, so that the  
xix. of Aprill may be in the hyghest or vppermoste parte  
of the instrumente, whiche is where they saye the lyne of  
the head to be, and the .xii. of October must be in the nea-  
ther parte. Also, the .xii. of January, in the ryght arme:  
and in the leaste arme, the .xvi. of July, and so the other  
dayes that doo fall to the other lyne, acording as they  
answere to the right assension of the sunne, as you may  
see in this figure.

This being thus diuided, you must also diuide the  
spaces that are betwene the one lyne and the other, into  
the dayes whiche be numbred in euery space: so that  
betwene the .xix. of Aprill, and the thirde of June, are  
45. dayes, and that space shal you diuide into 45. par-  
tes. And whereas the instrument being small, it canne  
not in so lytle space receaue so manye partes, you shall  
diuide it from true, to feue partes, and so shall you diuide  
the other spaces by the numbers that are signed in them.

Then

When one daye moze before the .x. towarde the left hand,  
you shall make a strike, and there shall be the .xx. of Aprill.  
And syue dayes moze before, make another strike, and  
there shall be the .xxv. And yet other siue dayes moze before,  
which shall be the .xxx. of Aprill) make an other strike over  
thwart vnto the neathermost circle, and there shall May  
begynne. And from these dayes that you begyn to accompt  
the dayes of Maye from syue to syue. And in the last space  
you shall put syre, whiche shall make the one and thytie  
dayes that May hath.



And

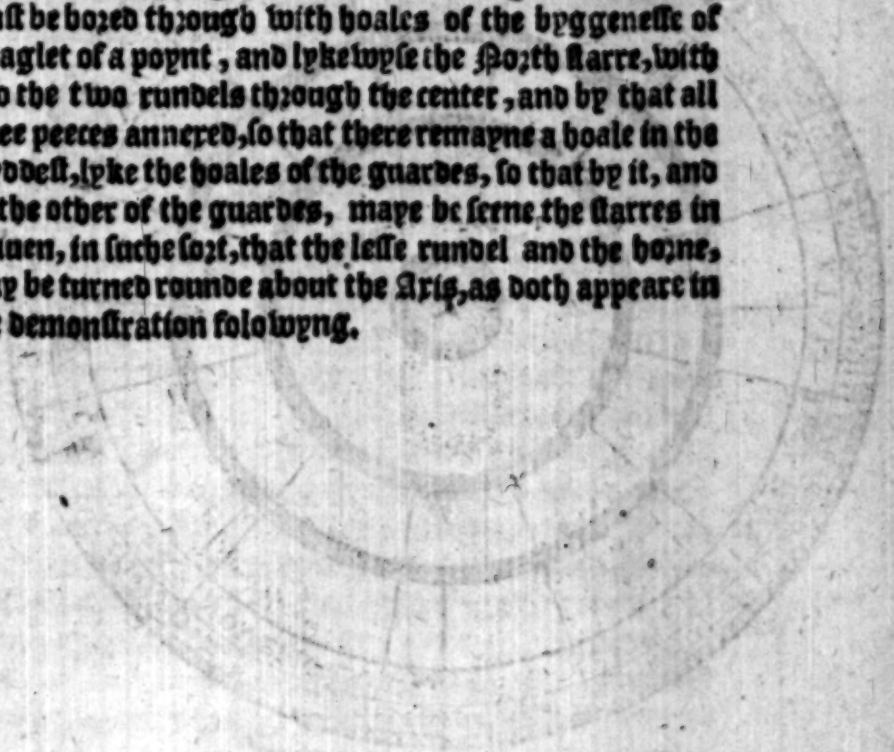
And there shall you make an other style which shall tra-  
verse or overthwart vnto the lesse circle. And in this man-  
ner shall you diuide the other monethes, geuyng to euery  
of them the number of his dayes.

This being done, vpon the outwarde part of the great  
circle, you shall cut rounde the paper, paste, or plate of la-  
ton, leauing of the same for a signe or marke a floure. De-  
lute vpon the. xix. of Aprill, for that it muste be the head:  
and lyke wyse at the. xxi. of October, may be left a han-  
del to holde it by. Then muste you make a rundell of the  
same paste or laton, of the bygnesse of the lesse circle,  
without the circumference whereof, shalbe left a toothe  
or inder, in the which you shal wyte, Tyme. And from  
the one syde of this inder towards the left hande, you shal  
drawe a ryght line, that may passe through the center to  
the circumference, and this shalbe the Peridian lyne.  
Also to this rundell you shall geue a circle, so muche lo-  
wer from the circumference, that there may be left a space  
where the numbers of the dayes maye be wytten. And  
this rundell you shall diuide into. 24. equall partes: be-  
gynnyng at the Peridian lyne of the inder at the twelfth  
houre of the nyght. When in the nexte space towards  
the left hande, you shall make the number of one. Lyke-  
wyse in the seconde space the number of two, in the third,  
the number of three, and so forth of the residue, vnto the o-  
ther twelue of the day, in the opposite or contrary part of  
the inder. So consequently proceeding .i. ii. iii. .cc. vnto  
the twelue of the inder, which shalbe the. xxi. houres of  
the naturall day.

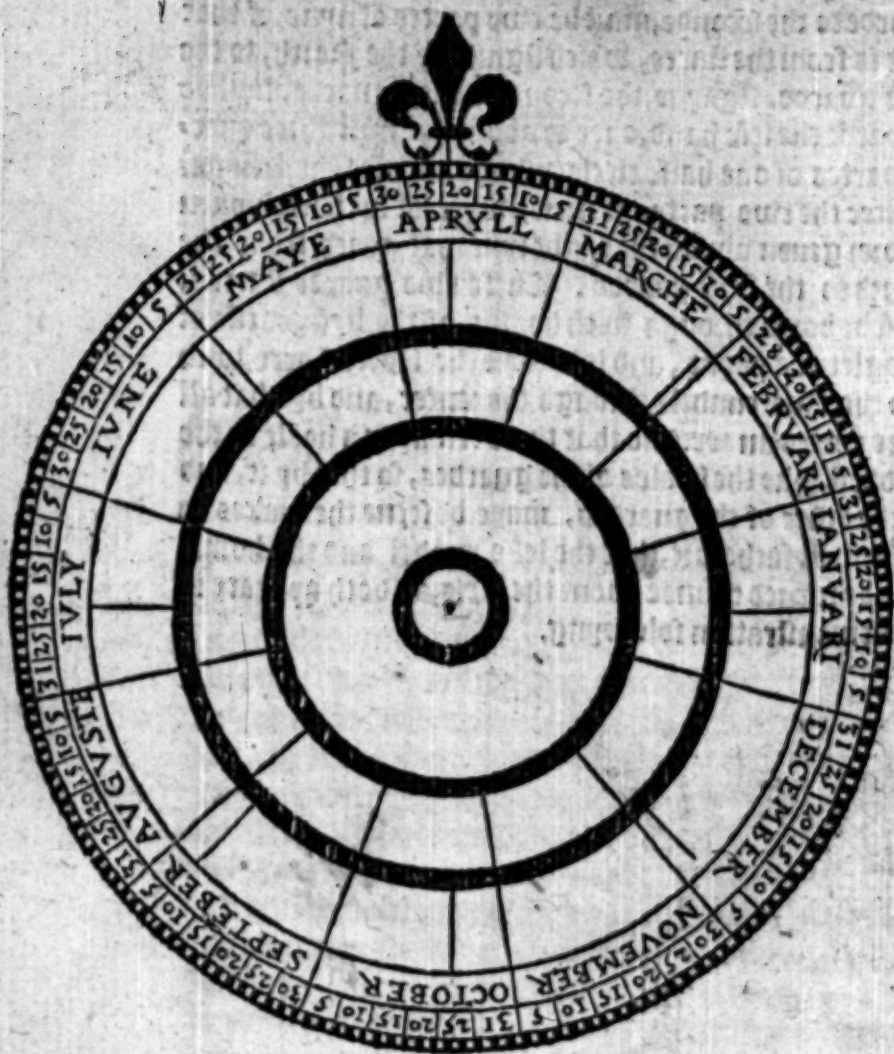
The hozne of  
the seven star-  
res which  
make the lesse  
beare.

Furthermore also, you must make an other peece of the  
same substance of past or metall, in maner of a hozne, in  
forme and order as are in heauen the seven starres which  
make the lesse beare. And this of such quantitie, that the  
first or forme garde starre, maye reache without the  
great rundell close to the circumference thereof: hauyng  
the North starre his center, with the center of the instru-  
ment. And from this starre or center, vnto the firste and  
forme garde starre, must be a right lyne, by the which  
the hozne muste be cut neare from the center, vnto the dis-  
coueryng

conseruyng o) thewpyng of the houres. Also from the fyrste  
 guarde to the seconde, must be two partes of nyne, of that  
 that is from the starre, which signifieth the South, to the  
 fyrst guarde. Agayne, the second and last guarde, must be  
 towarde the left hand, ouer o) above the fyrst, three quar-  
 ter partes of one halfe circle (whiche hath for the Semidi-  
 ameter the two partes of nyne, whereof we haue spoken  
 before) geuen vppon the ryght lyne that goeth from the  
 South to the fyrst guarde. These two guarde starres,  
 must be bozed througħ with hoales of the byggenesse of  
 an aglet of a poynt, and lykewys the South starre, with  
 also the two rundels througħ the center, and by that all  
 three peeces annered, so that there remayne a hoale in the  
 myddest, lyke the hoales of the guardes, so that by it, and  
 by the other of the guardes, maye be serue the starres in  
 heauen, in suche sort, that the lesse rundel and the bozne,  
 may be turned rounde about the Axis, as doth appeare in  
 the demonstration folowpyng.



## The second part.



To finde the  
houre with  
the instrument.

The instrument thus ended, and brought to perfection, when you desyre to knowe the houre, you shall turne the inner of the lesse rundel (in the whiche is wrytten, Tyme to that part of the great rundell where is marked the day in the whiche you desyre to knowe the houre: and directyng your face towarde the South, you shall make the head towarde the heygth of heauen, at the .19. of Apryl

of Appell. And seeyng in heauen by the hole in the myddest the starre of the North, holdyng the instrumente in suche compasse of the face, that by the circumference of the greater rundell, maye be seene the Guardes starres in heauen, you shal turne the hozne rounds about, vntyll it fall vpon the Guardes: so that by the two holes of the mouth of the hozne, the two Guardes starres maye be seene, and by the hole in the myddest of the North starre, and althzee with one eye: then the ryght lyne that goeth from the North to the firste Guarde, shall shewe in the lesse rundell, the houre that shalbe.

The.xviii. Chapter, of the time of  
the tydes, or rysyng and falling  
of the sea.



Keate accompte ought Pilots & Partners to haue of the tides, to take porte, enter vpon barres, passe by flattes, and finally, for all manner of navigations. For being ignorant hereof, greates hurt and inconuenience myght chaunce vnto them, as did of late to the valsaunt captayne Don John Gushman the Earle of Niebla, in the yere of. 1436. who was drowned before the cite of Gibraltax, for that the Partners kept none accompt, neyther had consyderation of the tydes. By reason whereof, not onely he was drowned, but also with him dyed many woorthy gentlemen, and valiant captaynes of Spayne.

The Partners holde for a certayne rule, that the Moone being in the North-east, or in the South-west, is full sea: and being in the Southeast, or North-west, to be lative water. They affirme also, that at the fyrste daye of the newe moone, the sunne being at North-east, and a quarter to the East, (that is North-east, and by East) the moone shalbe North-east, and then shalbe full sea, and three houres, and three quarters.

The Partners opinion of ebbing, and flowing of the sea, or tydes. Obseruation of the moone to knowe the tydes.

And

## The second part,

Eight principall wyndes

And at the seconde day of the Moone, when the Sunne shalbe at East North-east, the Moone shalbe at North-east, and then shalbe full sea, and foure houres and two quarters. *It* They accompte is, that the Sunne beyng in the North, is mydnyght: and beyng in the North-east, they accompt, three: and in the East, sixe. So that they accompt three houres from winde to wynde, by the eyght principall wyndes, or lynes, whiche the Spanyardes call Rumbos. These wyndes muste be imagined vppon the North, placed in the Angle, vnder, or beneath the earth: and the sunne and the Moone at the moouyng of the first moouable, and they ought not to be imagined in the Horizon, as the compasse sheweth. For speakyn by the tearmes of astronomie, you muste vnderstande, that the Moone touchyng in the circle of houres, at the number of three, is euer full sea: and touchyng in the same circle, at the number of nyne, is euer lowe water. So lesse ought they to obserue iust accompt of the houres, by quarters of houres. For, to geue 30. dayes to the Moone, it shalbe necessarie to accompt by the fyftes of houres, as shalbe sayde hereafter.

Here is to be noted, that the Spanyardes thynke (be lyke) that a North-east and South-west Moone, maketh a full Sea in al other places, as it dooth in Spayne. But in that they are greatly deceaued, and therefore the rule that they haue set forth for the tydes, serueth onely for suche places where it floweth North-east and South-west Moone a full sea.

The moone causeth the ebbyng & flowyng of the Ocean sea.

The moouing of the moone.

And the better to vnderstand the increasyng and decreasyng of the Ocean Sea, it shalbe conuenient to knowe the cause thereof, whereunto we say, that the Moone is the cause of ebbyng and flowyng, or rysyng and fallyng, increase or decrease of the sea: not onely by her lyght, but also by her secretes or hyd propertie. The Moone compasseth about the earth, from the East into the West, vntill she returne to the place or poynte from whence she departed: and in this course walleth or spendeth so muche more then one naturall daye, in holwe muche her proper moouing is more then the Sunne against the fixe moouable.

able, so that she maketh her turne or course about the  
 foure quarters of heauen in .xxiiiij. houres, & foure fiftes  
 of one houre, whiche are the .xii. degrees that she goeth  
 moze then the Sunne. And in this tyme the Ocean  
 increaseth and decreaseth twyle, so that this increasynge  
 and decreasynge, answereth directly to the course of the  
 Moone: whereby it foloweth, that the Sea increaseth sixe  
 houres and one fyfth part, & decreaseth other sixe houres,  
 and one fyfth. And yf this day at the .xii. houre, was full  
 Sea, the lowe water shalbe, at the syxt houre and one  
 fyfth part: and at the .xii. houre and two fyfth partes  
 it shall returne to be full Sea: and at the syxt houre and  
 three fyfthes, shalbe lowe water agayne: and at the .xii.  
 and foure fyfthes of the other day, shalbe ful Sea. So that  
 from one daye to another, the tyde both shorten foure  
 fyfthes of an houre, which is the tyme that the Moone  
 slacketh or tarpeth, moze then one natural day, to returne  
 to the poynt from whence she departed by the .xii. de-  
 grees, wheresof we haue spoken. Whereby it manifestly  
 appeareth, howe they beguyle them selues that say, that  
 the Sea increaseth syxe houres, and decreaseth other syxe.  
 For if it were so, the tydes should euer be at one selfe same  
 tyme and houre. But for as muche as there is moze then  
 .xxiiiij. houres, by the sayde foure fyfth partes, thereby is  
 caused the variation of the tydes: so that yf this daye, the  
 tyde be at one of the clocke, to morow it shalbe at one and  
 foure fyft partes, and the daye folowynge, at two of the  
 clocke and three fyftes. &c.

The shorten-  
 yng of the  
 tyde.

In error.

The variati-  
 on of tides.

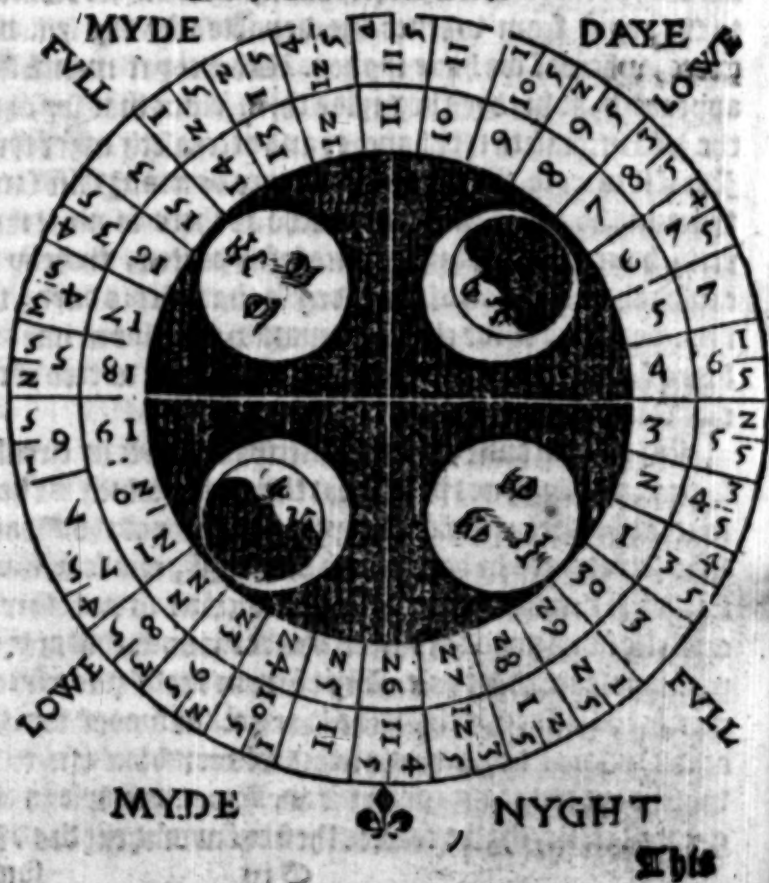
For this account, I wyll describe a Table in circular  
 fygure, although not pfect, for the causes whiche we haue  
 touched before in the fift Chapter, speaking of the Moone:  
 who sometymes in her mouynge is swyft, and sometymes  
 slacketh as much, because the conjunction is not euer in  
 one selfe same poynt of the Zodiacke, as the Mariners  
 presuppose for theyr rule. This fygure shall haue two cir-  
 cles, in the lesse (which shalbe the fyrst, and next vnto the  
 center) shalbe the dayes of the Moone, from one to .30.  
 whiche we count the conjunction. And in the second and  
 greatest circle, shalbe sounde the houres of the tydes. So

A table to  
 know the va-  
 riation of the  
 tydes.

## The seconde parte.

that, who so despyeth to knowe when the tyde shalbe, where it floweth Southwest and Northeast, let hym at that houre take heede to the dayes of the Moone, how many they are: as yf the be in the coniunction, or yf it be the fyrst or seconde of the Moone. &c. And the day being known, then in the seconde circle whiche answereth directly to the daye, shall he fynde when shalbe hygh water, or full Sea: and consequently, the ebbe, or lowe water, which shalbe sixe houres and one fyfth, after the full Sea, and so lykewyse may he iudge when shalbe the halfe tyde: and this as well at the tyme when it encreaseth, (whiche shalbe thre houres and halfe a fyfth part of an houre, before the full Sea) as also when it decraseth, which shalbe the halfe ebbe, thre houres, and halfe the fyfth of one houre, after the full Sea.

The Table foloweth.



This increasing and decreasing of the tydes, is not ever in equall quantitie. In the conjunctions and oppositions, they increase and decrease muche, whiche the Maryners call hight spring tydes, and the greatest increase of all, they call the hight springes. In the quarters of the Moone, (whiche are at the .7. and .22. of the Moone, or neare there about) they increase and decrease but litle: whiche the Maryners call nepe tydes, lowe waters, dead waters, or lowe fluddes.

The. xix. Chapter, of certayne signes, whiche prognosticate tempestes, or sayre weather.



Good Pilot or Maryner, ought not to be ignorant of certayne signes or tokens, whiche the naturall Philosophers describe of tempestes. For as they signifie vnto him, so shall he leane his port, or enter into it: which if he can not, then ought he with patience and hope, to tarye the time

that God hath appoynted for him, who moueth and troubleth the seas when it pleaseth him, & appeaseth them againe at his pleasure. Lesse hurteth & damageth the shroks which we see comming, or foresee, then that whiche hath stricken vs, & taken vs carelesse. When the sunne riseth faire & cleare, it signifieth a sayre day: but if it shewe yealow, or deable, tempest is like to folow. Againe, if at the rising of the sunne, his beames shew themselves contract, or gathered together, & shott, you shall haue raine: yf the mistes or cloudes make a circle about the sunne or moone, how much the greater that circle shall be, so much greater shall be the tempest to come: and if there shall be two circles, the tempest shall increase the more. And if it chaunce, that at the rising of the sunne, the cloudes be turned red, it is a signe of no small tempest. When the sunne or the moone shall haue a circle looke towarde the parte where it breaketh, & from thence shall wynde come: yf it departe, or disperse equally, faire weather shall folow. When the moone riseth bright &

Signes of  
sayre & fowle  
weather.

## The second part.

shynnyng with pure colour, you maye iudge it faire wea-  
ther: and if red, wynd: yf blacke, rayne. When in the new  
Moone, yf hoynes o2 corners appeare grosse o2 great, it is  
a token of tempest: and if sharpe, it signifieth faire weather.

The newe,  
Moone.

This that we haue saide, is the auctoritie of Plinie &  
Aristotle, to whom the prudent Partner shal credite, un-  
tyl he haue founde other moze certayne, eyther by his  
owne experience, o2 by the experience of other wyle men,  
woozthe to be beleuened. And euerye man ought to  
trauayle as muche as in hym is, for the knowledge of  
these thynges, acco2dyng as God hath geuen hym vnder-  
standyng and reason to obteyne the same: and this shalbe  
wysedome, bearing in memorie the experience of thynges  
passe, to gouerne presently, and to prouide for thynges to  
comme. The prouidence of God is so greates, that depri-  
uing byuite beastes of reason and vnderstandyng, he hath  
geuen them sensle, and naturall instincte, whereby they  
may knowe that, that menne doo vnderstande by reason.

The sense of  
beastes, in soze  
seepng tem-  
pestes.

Antes.

Swalowes.

Fysshes.

By this sense and secretc instincte of nature, the Antes  
o2 Wismares, with prouidence and diligence, laye vp  
in store theyr prouision and egges, when befoze they feeles  
the rayne to come. The Swalowes also when they feeles  
the wynter commyng, passe the Seas. Lyke wyle, the Fy-  
shes, when they perceane stormes to come, goe downe to  
the bottome of the water, and hyde them in the mudde of  
the Sea. And although it may seeme beside my profession,  
to meddle with matters parteynyng to Diuines, yet wyl  
I not omit to speake that Chrylle our Lorde sayth, as  
testifieth S. Matthewe. When the Pharisees with the  
Saducees (to tempt hym) wylled hym to shew them sig-  
nes from heauen, he aunswared, saying, When it is ene-  
nyng, you say it shalbe faire weather, because the hea-  
uen is redde: and in the moynyng, you say it shalbe tem-  
pesse, when you see that the beaunc dyrectly towarde  
redde, &c. They knewe by that they iudged of heauen, to  
determine thynges to come: as whether it were wyll to  
take iourney, to enter the sea, to reape Cozne, to laye it  
abroade, o2 to geather it in. I saye, that to vnderstand the  
reason that mooued them to haue suche consyderation of  
time,

Matth. xvi.

tyne, (which we nowely ke wple obserue,) it is necessary to knowe that the redde colour whiche appeareth in the evening, signifieth the drynesse of the ayre, whereby the matter of the grosse vapours which should be conuerted into water, is so much dried, that it appeareth in manner inflamed, and is therefore redde, and so is it not aptly disposed to be conuerted into water, and is therefore the nearest signe of saye weather. The other signe, when the heauen in the mornynge bryneth toward rednesse, (yet not redde) sheweth manifestly that rayne shal folow. Whereof the cause is, that this matter is ingrossed, because this colour can not be but in grosse and thick matter, whiche is not dyed, and therefore is not redde, as the cloudes that appeare in the West, in the tyne of saye weather: but it is a matter somewhat troubled, and partly redde, and is therefore a confounded matter, which touched with the heate of the sunne, and therewith broken and dispersed, falleth downe, and is conuerted into water. And further, as touchyng the sayde troubled or grosse matter, I saye, that the drye and ruddie parte thereof, is eyther turned into wynde, by drynesse, or els beyng compassed about, and inclosed with moyste matter, is altogether conuerted into rayne, and so maketh tempest. For by tempest is meant, not onely rayne, but also tempestuous wyndes, with water.

The rednesse  
of the evening.

Ruddy the colour.

what is tempest.

Likewyse it is written by Saint Luke, When you see a cloude ryse in the West, you saye rayne shal folowe: and when the wynde bloweth South, you say it wyll be hotte. &c. To vnderstande this, I say the cause of this is, that rayne is made, or engendred of moyste vapours, whiche both maye be, and are ingrossed. Or otherwyse, a cloude is a grosse body of moill vapours so ingrossed, and when the cloude doth so ryse, it shalbe a signe that rayne shal shortly folowe. For that that was ingrossed in the cloude, shall soone be resolued into water. To the other reason, why they say that when the wind bloweth South, it wyll be hotte, I saye that that wynde is hotte and drye. Furthermore is to be considered, that the wyndes are sometimes drye, and sometymes moill, yet not by their owne

Luke. xii.

The generation of rayne or cloudes.

The qualities of wyndes.

## The seconde parte,

propertie, but according to the Regions by the whiche they passe. We see that in somme one Region it rayneth with one wynde: and the selfe same wynde in other places disperseth the cloudes. The Northwest wynde is drye in Spayne, yet in Lybia is it very moyst and rayny. The South wynde in Europe, causeth rayne in mooste places, and therefore the Portes named it the wynde of waters, and this wynde in Palestina or Iurie is drye. The cause of this diuersitie, is, that when that wynde bloweth in Palestina, it passeth by hoate and drye Regions, as by the desertes of Affrike, and passeth not by any Sea at all. But when it bloweth in these partes of Europe, it muste of necessitie passe by, and ouer the waters of the Sea Mediteraneum, or the Lenant sea, where it geathereth moysture, and causeth rayne. The Lenant or East wynde, in Malaga, and Gibraltar, is moyste, and in Sheres De la Frontera, is hoate as hell.

✱ The. xx. Chapter, of the bryght and shynying exhalations that appeare in tempestes, whiche the Mariners call Santelmo, or Corpus sancti,



Ignorance is the mother of errors, and therefore wyl I not omit to shew the naturall cause hereof, although among certayne simple and ignorant people, it is accounted for a myracle, that in certayne tempestes on the sea, the Mariners see certayne shynying & bryght fyres, which with great super-

stition they kneele downe vnto, and pray vnto, affirmyng that it is Santelmo that appeareth vnto them, and not contented herewith, somme sweare that they haue scene droppes of greene ware fall downe. Other affirme that this ware is of suche beate, that if it fall from the top of the shyppe, it doth melte the rosen and pitche of the battes of the shyppe, with such other foolishe imaginacions, and therefore it shalbe good bryeflye to speake hereof, to

stoppe

Some call  
these the fyres  
of S. Clin  
and Saynt  
Nicolas

stoppe the mouthes of suche sonde and ignorant persons. The exhalations or vapours of the grosse fumes or smokes that ryle from the earth, are constrayned or geathered together by the coldnesse of the nyght, and the ayre, & are thickened in the firste region of the ayre, next vnto the earth. This may, and is wont to be inflamed or kyndled, and yf it finde a body whereunto it may cleane, it abyeth in that vntyl it be consumed. This fire is cleare, and shynnyng, and yet burneth not. The Grekes call it Polydeuces: and the Latines call it castor and Pollux. It is accustomed to appeare vpon the sholowes, and oftentimes is seene vpon the pykes of souldiers in the armies of men of warre, as Plinie wyrteth, and this, as wel by reason of continuall smoke, as also by the heate of muche people. Certayne it is, that smoke is none other thyng then fire dispearsed: as flame is an exhalation or euapozation that ryleth in maner of a smoke, from a grosse or fat body, and at the tyme that it ryleth, beyng geathered together, is constrayned into flame, inueltured with fire. This resplendence or shynnyng, is also oftentimes seene, not only in iourneyng by land, but also in sayling by riuers: and when it appeareth on the lande, it riseth of the smoke that is geathered together with the colde ayre of nyght, and on the bankes of ryuers: this smoke is geathered of the exhalations of the water, and consequently being kyndled, appeareth byght and shynnyng. But now let vs come to the shyppes that sayle by the sea, and to the Maryners that are accustomed to tempestes. To them therefore I say, that that light, or such other lights as they see, is engendered of the fumes & smokes of their shippe, with the heate of menne couched close and neare together in a narowe place, and when a tempest ryleth, the sayd smoke is thickened, prest together, and beaten downe by the wyndes, in suche sorte, that beyng tossed from one syde to an other, it is set on fire by moouing, and taketh holde sometyme on the sholowes, and sometyme on the top, and sometyme also in the poupe, or in the foreshypp: So that to see this light, or the same to appeare, is a natural thing, and not supernatural.

wandering  
fires engendered of exhalations and vapours.

Castor and Pollux.

what is smoke and flame.

Exhalations of the land and water.

Exhalations & vapours engendered in shippes.

## The second part.

**A Shynng fye**

**A Superstitious opinion of the Maryners.**

**A fye of the Fryer preachers.**

**Psalm. lxxviii.**

**Testimonie of auncient authors.**

When captayne Beyerre was at Coxon, in the Emperours Panie, with his companie of Souldiers, he chaunced to be in a tempest, and sawe the sayde fye of Santelmo, whiche shortly after descended so lowe, that the captayne myght easely come to it: and takyng it in his cloke, he founde it to be a litle droppe of water. Somme haue thought it to be a certayne shynnyng fye, called Faros, whiche the sea men sometyme see in a calme in the Sommer season: and thus Santelmo appeared no moze. The captayne remayned astonished at the mockerie, and the other perceaued it to be no miracle. The opinion of the Maryners that affirmed it to be Santelmo, maye rise of Saint Erasmo, Bishop of Naples: who (as they saye) not onely in his lyfe tyme, but also after his death, was a patron and helper of Maryners that called vppon hym in tempestes. This name of Erasmo, they of Naples, call Cremona: and proceste of tyme takyng awaye one. e. by the fygure of Syncope, remayned the name of Santermo. And the Spanyardes, who neuer canne long keepe anye strange vocable, call it Santelmo, turnyng. e. into. l. Yet of this Santelmo, whereof the Maryners speake, there is neither scripture that maketh mention, nor auctoritie that confirmeth it. I heare say, that the Fryers preachers, had a religious man, of commendable lyfe, & good conuersation, named Fryer Pero Gonzales, borne in Calizia, and that in his lyfe tyme, our Lord dyd certayne miracles by him, and that this is he that shyneth and geueth light in tempestes. No doubte, but God woorketh miracles in his Saintes, and by his Saintes, as sayth Dauid. But if this seruaunt of God was Pero Gonzales, how then shal he be Santelmo? Another difficultie there is, as touching this lyght: for there are wytynges of moze antiquitie then the lawe of grace, and comyng of Christ in flesh, whiche geue testimonie hereof. For the Poet Virgil, in the seconde of his Aeneidos, wytteth, that this fyre appeared vppon the head of Iulius Ascanus. And Titus Livius in his fyrste booke, affirmeth, that it appeared vppon the head of Seruius Tullius, the syxth kynge of the Romanes.

Pomponius Articulus saith, that Rome begonne to be build-  
 ed in the thryde yeere of the thirde Olympiade, that is, in  
 the tenth yeere of Iothan kynge of the Iewes. And from  
 the creation of the worlde, 3201. yeeres, and 729. yeeres  
 before Christe our Saviour was borne, the kynges  
 of Rome were seven, and reigned 244. yeeres. Eusebius  
 sayth, they reigned 246. Seruus Tullius reigned 44.  
 yeeres, Tarquinius Superbus 23. yeeres after hym. So that  
 discountyng these yeeres, it shall appeare clearly as I  
 say. And although the yeeres were not discounted, let  
 them reade Diodorus Siculus, an ancient wyter, let them  
 reade Plutarchus, Aristotle, and other old authours that  
 haue wytten hereof, and they shal finde, that in tempestes  
 be neare vnto the sea, these fires and lyghtes appeare in  
 them: and appeared not onely to the Gentiles, but at this  
 day also appeare to the Turkes & Moores in tempestes.  
 When onely one lyght appeareth, it is taken for an euill  
 signe: And hereof sayde Propertius thus.

The building  
of Rome.

The Romane  
kynges.

Candida foelici soluite vela toro.

And why it is an euill signe, this is the cause, that yf  
 the tempest that ryseth be greate, it choketh the erbalati-  
 on, although yet by the parte leaste troubled, it appea-  
 reth. When there are two lyghtes, it signifieth that in  
 the ayre is great aboundaunce of grosse humours, and is  
 a token that it is sufficient to consume the matter of the  
 tempest, or that the tempest begynneth to ceasse, and the  
 grosse humour hath the maisterie. But sometime it chaun-  
 ceth, that two lyghtes appearing, there may be tempest,  
 and one appearing, shall not be so great, and oftentyme  
 there is tempest, without any lyght at all seene. The blind  
 gentillite called these Castor and Pollux, and placed them  
 in heauen in the signe of Gemini.

One light or  
fyr is an euill  
signe.

Two lightes

Castor and  
Pollux.

Nowe remaineth to aunswere to one obiection of  
 the Daryners, who say, that neuer man that hath seene  
 these fyres, hath perished. To this I say, that manye  
 may see, and haue seene these lightes, of whom, some haue  
 ben in peryll, and some drowned: Notwithstanding, no  
 man

In error of  
the Daryners

## The second part.

man can affirme, that yf the drowned myght speake, they  
 woulde say that they had seene them. Therefore the wise  
 Christian Martyr ought to haue a cleare consci-  
 ence, and to call for the helpe of almyghtie God,  
 lifting vp his eyes and handes vnto heauen,  
 and say with the Prophet, Saluum me fac  
 Deus, quoniam intrauerunt aqua vsque  
 ad animam meam. Sane me, oh my  
 God, for waters haue entred  
 euen vnto my soule.

**Psalm. lxxviii.**

**¶ Here endeth the seconde parte.**

# The thirde part, entreateth of the composition and vse of Instrumentes, and Rules for the Arts of Navigation.

## \* The fyrste Chapter, of the number, order, and names of the wyndes.



**S**o greatly esteemed was Eolus, was sayned  
kyng of the Colas Ilandes, or I-  
landes of Vulcane, for hauing rea-  
son and knowledge of the wyndes,  
that they of auncient tyme called hym  
the God and Lord of them. With no  
lesse consyderation, the prudent Spar-  
ner ought not to be ignorant of them, for as much as the  
vniuersal benefite, & commoditie of Navigation consisteth  
therin. And to haue the better knowledge therof, you shal  
vnderstand, that wynde is fruite of the ayre, & vapour of  
the earth: the which by reason of his subtiltie, pearceth  
the Ayre, Arsketh it, & ensojeth it. Other say, that wynde,  
is Ayre, moued or tossed by the vehement influence of  
vapours of contrary qualitie. It is in Latin called, Ven-  
tus, because it is vehement, and violent, whose force is so  
great, that it ouerthroweth not only heapes of stones, or  
rockes, & casteth downe trees: but also disturbeth the ayre  
and the earth, & motieth the Seas. There are foure prin-  
cipall wyndes, whiche come from the foure cardinall or  
principall poyntes of the Horizon: we haue sayd that the  
Meridian circle, cutteth the Horizon in two poyntes, (that  
is) in the North and in the South, and the Equinoctiall  
cutteth it in other two, that is, in the East and West, and  
from these foure poyntes, come these foure wyndes, wher-  
of also the holy scripture maketh mention. These foure  
wyndes, they in auncient tyme, named in this manner.  
That that commeth from the East, they called Subsola-  
nus, which we call the Leuant, or East wynde. That co-  
mcth from the South, they named Auster, which we call  
the Meridian, or South wynde. That commeth from the  
West, they cal Fauonius, which we call & Ponent or west.

why Eolus  
was sayned  
God of wynde  
des.

what is wind  
subtiltie  
pearceth

The.iii. prin-  
cipal or car-  
dinal of wynde  
des

Luke .xviii.

called  
Fauonius

west

That

## The thirde part.

**North.**

**Collaterall  
wyndes.**

**Twelve  
wyndes.**

**Eyght whole  
wyndes.**

**Diuision of  
the Horizon  
by the foure  
principall  
wyndes.**

**Eyght halfe  
wyndes.**

That from the North they named Septentrio, or Aquilo, or Boreas, which we call North. To euery of these foure wyndes, they adioyned two collaterall wyndes, in manner as foloweth. That that is from the East towarde the parte of the North, where the Tropike of Cancer ariseth, or commeth forth, they called Vulturius: and that that is from thence towarde the part of the South, where riseth the Tropike of Capricorne, they called Eurus: also that is from the West, towarde the part of the South, where the Tropike of Capricorne goeth downe, they call Africus: and that that declineth to the North, where the Tropike of Cancer goeth downe, they call Caurus. The collaterall of the North and of the South, answereth to the circumferences of the Polar circles: that that is from the North towarde the Levant, or East, they call Aquilo: and that declineth towarde the West parte, they call Circius: that is from the South towarde the East, Euro Auster, and toward the West Euro Africus: thus many hath Aristotle in his Meteorica, with these xii. wyndes, they sayed in olde tyme, and made their compasse by them.

The Hydrographers of late dayes, and suche as are trauayled and exercised in sayling, agree with the ancientes in the foure principall wyndes, although they haue chaunged the names, calling the Levant or Orient, East: the Ponent or Occident, West: the Septentrionall, North: and the Meridional, South. Betweene these foure wyndes, they diuide euery quarter of the Horizon, into two halfes, made of the two nearest, in this manner: Betweene the North and the East, taking name of them both, they name the Northeast. Betweene the East and the South, they name the Southeast: and betweene the South and the West, Southwest: betweene West and North, Northwest. These eyght wyndes in Nauigation, they call whole wyndes.

Betweene these eyght wyndes, they place other eyght, that are called halfe wyndes, whiche also are named of the two that are nearest vnto them: That that is betweene the North & Northeast, they call Northnortheast: betweene

Between North and East, is Eastnortheast: and so North  
of the other. Beside these halfe wyndes, they haue other  
whiche they call quarter wyndes. These take the name  
of the wyndes to the whiche they declyne: as yf to the  
quarter from the North, towarde the Northeast, they call  
it North, and a quarter towarde the Northeast: that is,  
North and by East. And that that is towarde the North-  
west, they call North, and a quarter towarde North-  
west. And so of the other, as shalbe verifed in the figure folo-  
wyng: whereof is geathered, that diuiding the eyght

Quarter  
wyndes.

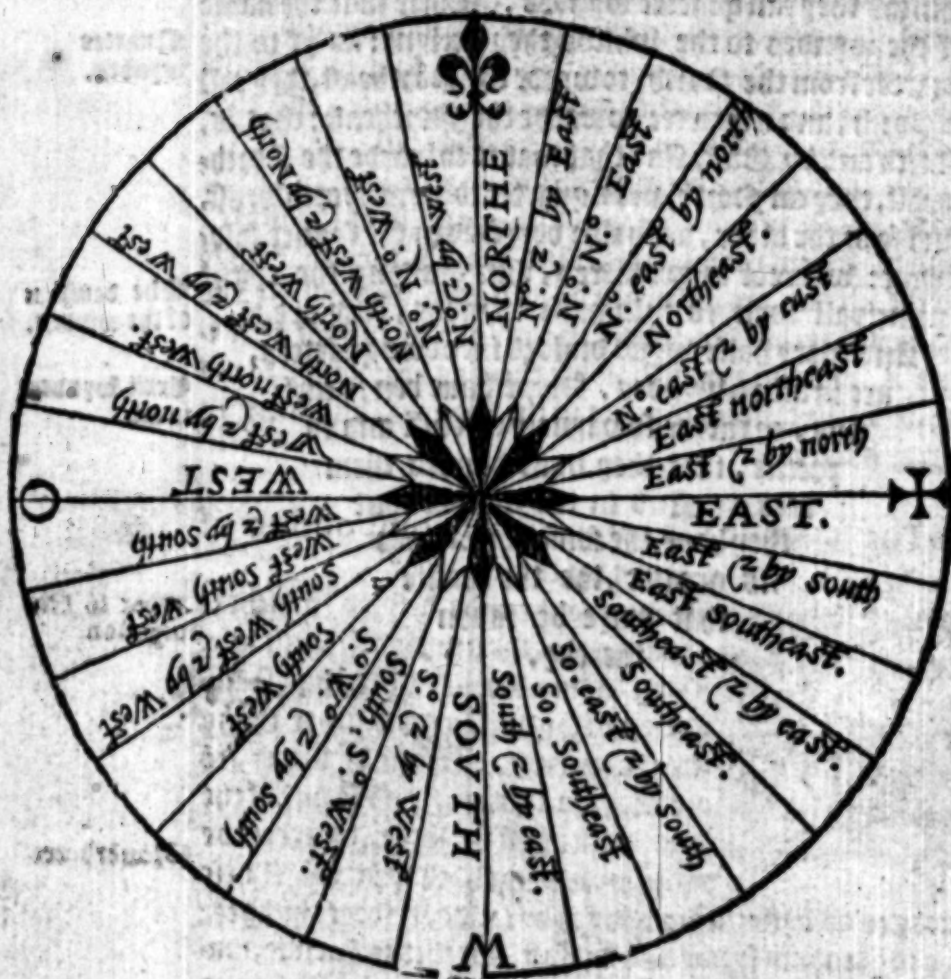
The deuision  
of the wyndes.

Went. wyndes  
in all.

And every halfe wynd diuided into two quarters,  
are in all. 32. wyndes. Some haue ben so curi-  
ous, or rather so baynely carefull and to  
precise, that they haue diuided them  
into. 64. And in the Cardes that  
they haue, the confusion of lines  
is greater, the the profits  
that maye be taken  
thereby.

The

The second part,  
The demonstration of the wyndes.



These names do they vse that sayle by the Ocean sea. And it seeme: h that they had their beginning of the Almanie or Flemishe tongue: For these nations chiefly sayle in the Ocean. They that sayle in the sea Mediterra-nean, or Euidne sea, call them by other names, taking original of the Tuslane or Italian tongue. Or els that they haue denomination of the partes from whence they come in respect of the sea Mediteraneum. As the wynde called Græco, because it cometh from Grecia. And Libeco, because

The names  
of the wyndes  
in the Italian  
or Tuslane  
tongue.

because it commeth from Lybia, and Syroccho, because it cometh from Syria. And beginning at the North, these are their names, Tramōtana, Græco, Leuante, Ponente, Maeltro, and that that is betwene Tramōtana and Græco, they call Græco Tramontana, and that is betwene Græco and Leuante they call Græco Leuante, and that is betwene Leuante and Syroccho, they call Leuante Syroccho, and that is betwene Syroccho and Mezzo Iorno, they call Mezzo Iorno Syroccho, and so of the other: and the lyke of the quarters. And because they that sayle in the Ocean, are governed by altitudes, we wyll vse the names that they vse, where we intende to intreat of altitudes, and every man shall vse them as he lysteth, for as much as the difference is not in the wyndes, but onely in theyr names.

\* The seconde Chapter, of the composition of Cardes for the sea.



Driving to the ende desired (whiche is what is Navigation, the principall intent why I began this worke) I say, that Navigation or sayling, is none other thyng then to journey, or viage by water, from one place to another, and is one of the soure difficultest thynges, whereof the moste wysse kyng hath wrytten. These

what is Navigation.

Proverb. xxx.

viages do dyffer from viages by lande, in thre thynges: for the lande is firme and stedfast, but this is florible, waueryng, and moueable. That of the lande, is knowen and terminated by markes, signes, and limittes, but this of the Sea, is vncertaine and vnknotwen. And if in viages by lande, there are hilles, mountaynes, rockes, and craggye places, the sea payeth the same senen folde with toymentes and tempestes: therefore these viages being so difficulte, it shalbe harde to make the same be vnderstode by wordes or wryting. The best explication, or inuentiōn, that the wittes of menne haue founde for the manifestyng of this, is to geue the same paynted in a Carde.

The danger and difficultie of Navigation.

For the draughte, or making whereof, it shall be requysite to knowe two thynges: wherof the one is, the

Making of Cardes for the Sea.

the

## The second part.

**The wyndes  
or lynes are  
called Rum-  
bos, in the  
Spyns the  
tongue.**

the ryght position of places, or placing of countreys and coastes. The other is, the distances that is from one place to another, and so the Carde shal haue two descriptions. The one that aunswereth to the position, shalbe of the wyndes whiche the Mariners call lynes or poyntes of the compasse: and the other that aunswereth to the distances, shalbe the drawyng and poynting of the coastes of the lande, and of the Ilandes compassed with the Sea. To paynt the wyndes, or lynes, you muste take skynnes of parchement, or large paper, of such bygnesse as you wil the Carde to be, and in it drawe two ryght lynes with blacke ynke, whiche in the myddest shal cut or diuide them selues in ryght angles, the one accordyng to the length of the Carde, whiche shal be East and West, and the other North, and South. Upon the poynt where they cut, make a center, and vpon it, geue a prysse or bydde circle, whiche may occupie in maner the whole Carde. This circle, somme make with lead, that it may be easily put out: these two lynes diuide the circle into foure equall partes, and euery parte of these shal you diuide in the myddest with a prycke or puncte. Then from one punt to another, drawe a ryght Diametral lyne with blacke ynke: and so shal the circle remayne diuided with foure lynes, into ryght equall partes, whiche corresponde to the ryght wyndes. In lyke maner shal you diuide euery of the eight into two equall partes, and euery part of these is called a halfe wynde. Then drawe from euery punt, to his opposite Diametrally a ryght lyne, of greene, or azure: lyke wyse shal you diuide euery halfe wynde in the circle, into two equall partes. And from these punctes, whiche diuide the quarters, you shal drawe certayne ryght lynes with red ynke, whiche also shal passe by the center, whiche they call the mother Compasse, or chiefe compasse of the Carde, being in the myddest thereof: & so shal come forth from the center, to the circumference. 32. lynes, whiche signifie 32. wyndes. Beside these sayd lynes, you shal make other equall distant to them, & of the selfe same colours, in this maner. From the pointes of the wyndes & halfe wyndes that passe by the center, drawe certain right lynes, & passe

**The mother  
compasse of  
the Carde.  
xxx. lynes  
whiche spall  
be so many  
wyndes.**

not

not by the center, but be equallye distant to those that passe by the center, and of the same colours and equall distance, as are they that passe by the center. And as these lines concurre together as well in the center, as in the poyntes of the wyndes, and halfe wyndes, that are in the circumference of the circle, they shall leaue, or make there other .16. compasses, euerie one with his .32. wyndes. And yf the carde be very great, because the lynes may not go farre in sunder, if you wyll make there other .16. compasses, you must make them betwene the one, and the other of the syde .16. poyntes, where the quarters are made with theyr wyndes, as we haue sayde. It is the custome for the most parte, to paynt vppon the center of these compasses, a flowre or a rose, with diuers colours, and golde, differencing the lynes, and marking them with letters and other markes: especiallve signyng the North with a flowre Deuce, and the East with a Crosse. This, besyde the distinction of the wyndes, serueth also for the garnishing of the carde. And this for the mosse part is donne after that the coaste is drawen. And thus much suffiseth for the draught of the wyndes.

The placing  
of many com-  
passes in the  
carde.

The flowre, or  
rose of the cen-  
ter.

The North.

The situation of the places, Portes, and Ilandes in the Carde, accordyng to theyr proper differences, consisteth in the particuler, and true relation of suche as haue trauelyed them. And therefore for this purpose it shalbe needfull to haue paterne of coastes, portes, and Ilandes, whiche must be paynted in the Carde, and these of the best and most approued to be true: and not only to haue paterne well paynted, but also it shalbe necessarye to knowe the true altitudes of the Pole, of certayne principall Capes, Portes, and famous Citties. This done, they must be translated into certayne thynne papers, and transparent, that may be seene through: and those of the best and finest that may be had, annoyntyng them with oyle of Line seede, and then dryng them at the Sunne. Then take the paterne or Carde that is to be translated, and reach, or stretch it forth vpon a table. Then put the transparent paper, vpon the one side of the paterne where you wyll begyn. And the paper being made fast vpon the

The situation  
of the places.  
ec.

Translation  
of the Carde,  
from one to  
another.

### The third parte.

paterne with plomettes of leade, or a little ware that  
 maye easely be taken of, you shall in the transparent pa-  
 per marke, with a fine penne, one East and West, and  
 one North and South, or two, upon those that are seene  
 by the selfe same paper in the paterne. And this is called  
 tracing, or translating. In lyke manner shall you trace  
 all the coastes, Havens, Portes, Landes, Cities, Capes,  
 and Ryvers, as appeareth in y<sup>e</sup> Paterne, unto the Rocks  
 that come forth of the water, and the knowne bankes.  
 And because this paper doth not suffice, you shal put there  
 to another, and more as needs shall requyre. And begin  
 the translation, in one, where the other endeth, untill you  
 have translated all that you desire, not forgetting to make  
 in every one, lynes of North and South, East and West,  
 to serve for markes afterwarde. So that the lyne of North  
 and South, of the one paper, maye lorne close and even,  
 with the lyne of the North and South of the other paper  
 that is lorned to it by longitude.  
 And the Paterne thus translated into these papers, you  
 must put the ruled or lined paper, or papers upon a plaine,  
 smooth, and steadfast table, where you shall stretche them  
 forth, and make them fast with plomettes or wayghtes,  
 or nagle them to the table by the sydes and corners, with  
 small nayles. Then upon the sayd ruled paper, you shal  
 put the paper that is translated from the paterne, in that  
 syde or part that is correspondent from the paterne, to the  
 ruled Carde, so that the lynes of East and West, North  
 and South, of the translation, may be upon the lynes that  
 aunswere to them in the ruled Carde.  
 This paper thus made fast by the one syde or  
 parte, you shall by the other syde (that it maye remayne  
 in his place) put under it another fine paper, smoked or  
 singed on the nethermost parte (whiche is that, that sal-  
 leth upon the ruled Carde) epyther with a lynke, or with  
 matches of pitche. These thus ordered, and made fast  
 one upon another, you shal take a Steele bodkyn, or wyre  
 with a smooth and blunt point, that it rase not, or hys  
 not the paper, and with it shall you drawe, pressing by-  
 pon all the translation, and tracing it with diligence  
 and

Some do this  
 only with oyle.

Tracing of  
 the carde.

and discretion, marking ever howe much in it is translated from the paterne: sauing the wyndes or lynes which the Paryners call Rumbos, and so shall remayne all the impression of the smoke in the ruled Carde. Uppon the which, with a fyne penne you shall trace with ynke: which being dry, you shall with crummes of bread make it cleane from all the smoke, and so shall the coaste appeare in the Carde drawen with ynke.

This done, then with a small penne shall you describe in the Carde, all the places and names of the coaste of the Carde, in that parte where they are, as they are seene in the paterne. And fynde, you must describe in reade, the Portes, principall Capes, famous Cities, with other notable thynges: and all the residue in blacke. When shall you drawe or paynte Cities, Shippes, Banners, and beastes, and also marke the regions, and other notable thynges. When also colours and gold that you garnishe and beautifie the Cities, Compalles, Shippes, and other partes of the Carde. When shall you set forth the coastes with greene, by the shore or bankes of the landes, and make them sayre to sight with a lytle saffron, or other wyse, as shall seme best. Lyke wyse shall you describe certayne letters, with theyr significations, in this manner.

B. for a Bay. C. for a Cape. A. for an Angle. I. or J. for an Islande. P. for a Pountayne. P. for a Porte. A. for a Ryuer.

Then in place where is more roome, or that is least occupied, you shall drawe two ryght lynes, equally distant: and the one no further from the other then halfe a synger, or lytle more, and so long, that betwene them maye be marked at the least thre hundred leagues. And this the Paryners call the trunche or scale of leagues, and place it or use it in this manner. They take with the compasse, a hundred leagues of the trunche of the Carde or paterne that is translated. And they set them fast betwene the two lynes, and this space they part by the halfe, and reast the foote of the compasse in 50 and these divided agayne equally in 100 partes, they reast the compasse in 15, and the 25, being lyke wyse divided, they

The making  
of the trunche  
or scale of the  
leagues.

first of 100  
the same was

to 1000 100  
3000 100

# The third parte.

they reach in .xii. leagues and a halfe, and marke them as appeareth in the demonstration folowynge.



The gradua-  
tion of the  
Carde.

The Carde beyng thus made, then to graduate it, or di-  
vide it into degrees, you must drawe three lynnes, whiche  
make ryght angles with the lyne of East & West, equi-  
distant to the lyne of North and South: and they also  
shalbe North and South. These shalbe drawn by the  
Ilandes of Afores, or Soria, or nearer to Spayne, or  
where the Carde shalbe lesse occupied. And for this pur-  
pose, the one lyne must be so farre distant from the other;  
that in the two spaces which they make, may be marked,  
in the one, the degrees, and in the other, the number of  
them, conformable to the graduation of the paterne: as the  
numbers of degrees shew East & West, with the por-  
tes, capes, and coastes in theyr proper altitudes.

And yf the Carde have no graduation, you shall take  
with the compasse in the trunke of the leagues, seven spa-  
ces of .12. leagues and a halfe, whiche are .87. leagues and  
a halfe. And these must be divided into fyve partes, which  
come forth at .17. leagues and a halfe for a parte: and the  
foure partes taken with the compasse, make foure de-  
grees: and divided into foure partes, every parte is a de-  
gree, and is marked thus. ☉

The marke of  
a degree.

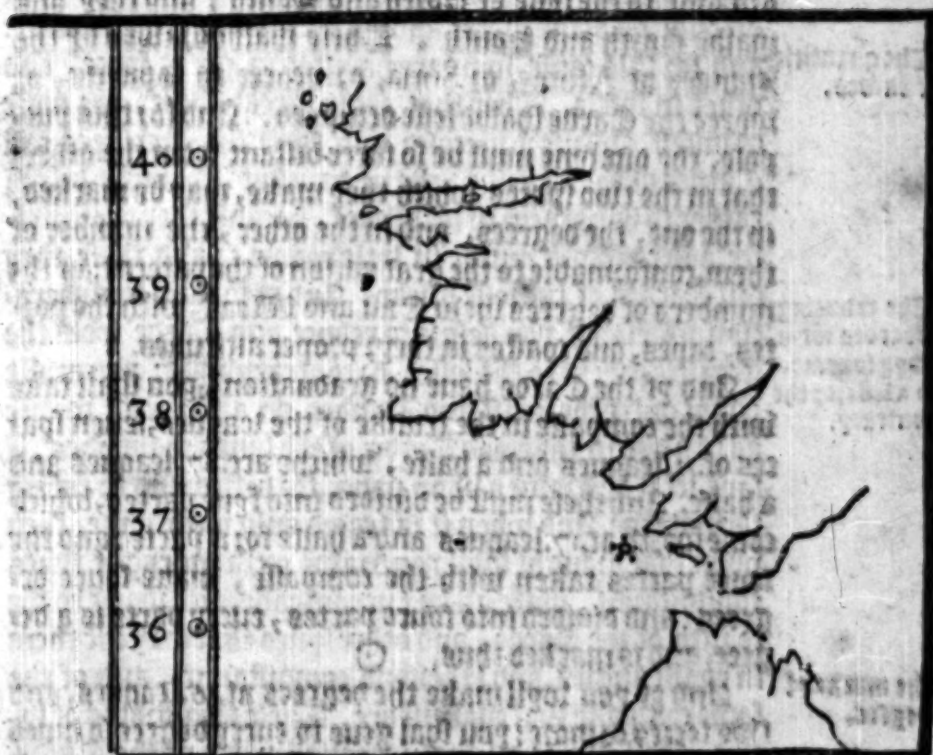
And yf you will make the degrees at .16. leagues, and  
two terces or more: you shal geve to every degree so much  
space as the leagues comprehend. This graduation must  
be begonne from some one cape, whose altitude of the  
Pole is well knownen. And the whole Carde beyng thus  
graduate, you must begonne the number of the degrees  
from the Equinoctiall lyne, one, two, three, &c. towarde  
the one Pole, and the lyke towarde the other: so that  
to the knownen Cape, maye answer the number of his  
altitude. And so shall you doo to the whole Carde. Also,  
the Equinoctiall lyne shalbe marked in his proper place.

And

And in lyke maner shall you marke the Tropicke accordyng as they are in the Sphere. But forasmuche as in Spayne, Cape Sainct Vincent is the principall: they begynne there to make graduation, and number it in .37. degrees. And from thence, towarde the Pole Arctike, the degrees do encrease. And from thence, towarde the Equinoctiall line, they deminysh: and from that lyne, to the Pole Antartike, they increase agayne (as we haue sayde) as is conteyned in the Carde, and as appeareth in this demonstration folowynge,

Cape Sainct Vincent.

Increasing and Diminishing of the degrees.



And yf the paterne haue neyther leagues nor degrees, you must take or knowe the altitudes of two Capes, that are North, and South, of thee degrees, and the difference of  $\frac{1}{2}$  degrees of the elevation, that is from the one Cape to the other, ye shall diuide all that space in so many partes, as so ech one part shalbe .17. leagues and a halfe, as answereth to one degree. Or accordyng to the opinion of the leagues of the roundnesse of the earth, as we haue sayd,

If the paterne haue neyther league nor degree.

## The thi rd parte.

as touchyng this in the eightieth Chapter of the fyfte part. In Spayne they vse with the compasse to take the space that is from Cape saint Vincent, to the myddest of the greatest Ilande of Berlinga, which they account three degrees: so that after .17. leagues and a halfe for a degree, they are .52. leagues and a halfe: and so much do they put in this space. Other put .50. leagues, accountyng after .16. leagues, and two terces for a degree, and in this maner they make of leagues degrees, and of degrees, leagues. The saylyng Cardes, haue no certayne byguesse limitted them, because they only represent the description of the water and earth, and not the quantitie: and for this cause, some are paynted in great space, and other in lytle. They that are in great space, are moze manifest, and moze p[re]cise: and these the Mariners call Cardes of the largest p[ri]cke or draught. Somme desyre rather to haue them in lesse space, because they are briefer, and conteyne muche in lytle roome: and these they call Cardes of the lesse p[ri]cke. And yf for any consyderation aforesayde, you desyre to reduce any Carde from the greatest p[ri]cke to the lesse, or contrarywys: you muste paynt onely the coast and Ilandes on a paper, in maner as you dyd in the ruled Carde, of the lynnes or wyndes. I saye, let it be drawen vpon paper, for destroying or raising the paterne. And when it is traced only with ynke, then vpon that draught shall you drawe certayne ryght lynnes equidistaunt, made all by one compasse, accordyng to the length of the Carde, and other lynnes that may cut them in ryght angles, and lykewys equidistaunt, and of the same compasse that the fyft are. These two orders of lynnes, shall diuide all the superficiall parte of the Carde, into perfect squares or quadratures. And it is to be noted, that the nearer the lynnes are ioyned togeather, and the squares the lesse, so muche the more perfectly maye it be reduced, and moze easely. When shall you take another paper, greater or lesse then the Carde, accordyng to the poynt that you desyre to reduce it vnto, and in the length and breadth thereof, you shall diuide so many spaces as are betwene the lynnes of the other paper: and yf it be greater,

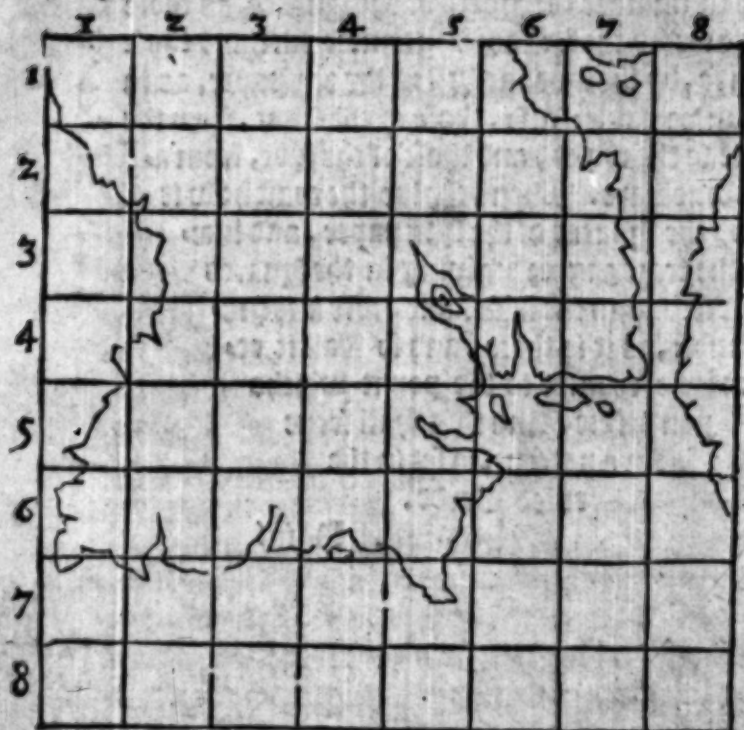
The quantitie  
of cardes.

The reducing  
of cardes for in  
a bpg fourme  
to a lesse, or the  
contrary.

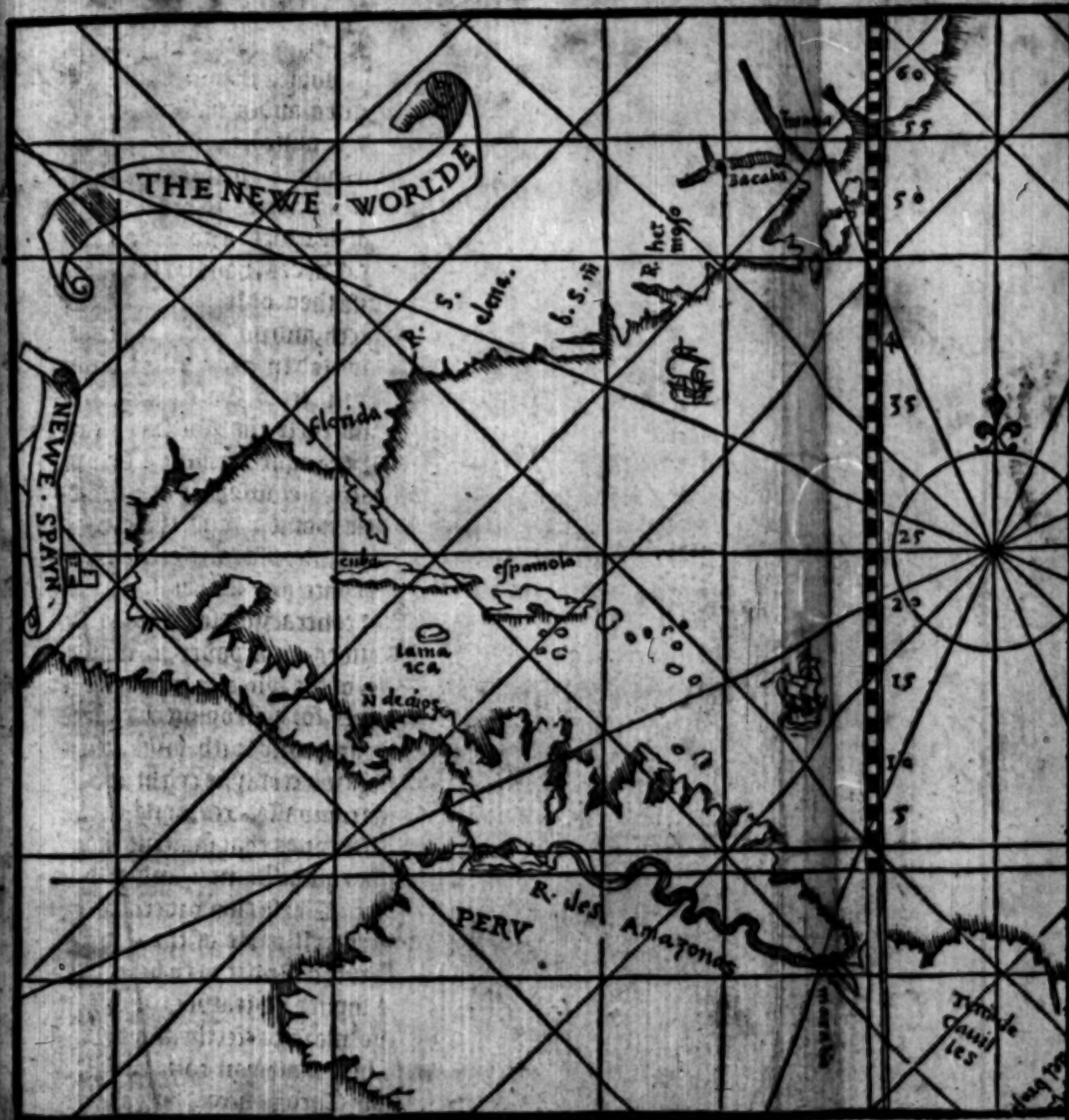
greater, the squares shalbe greater : and yf lesse, lesse.  
To keepe order in the correspondence of the squares (whiche  
shalbe a greates lyght to translate the one from the o-  
ther) you shall number the orders of the squares, as those  
of the longitude, by the front or bypermost part: and those  
of the latitude, by the syde, as wel in the one paper, as in  
the other, conformable: also, those of the front, from the  
least hande to the ryght, and those of the syde, from a  
boue, downeward. When beholde the coast how it  
goeth by the squares of the first paper, and like-  
wise the traceyng or drawing in the squares  
of the second, in the selfe same order and pro-  
portion, as it is there, and so shall it re-  
mayne reduced to the point whiche  
you desyre. And this shall serue  
for a paterne, to set in the  
ruled Carde.

¶ IIII

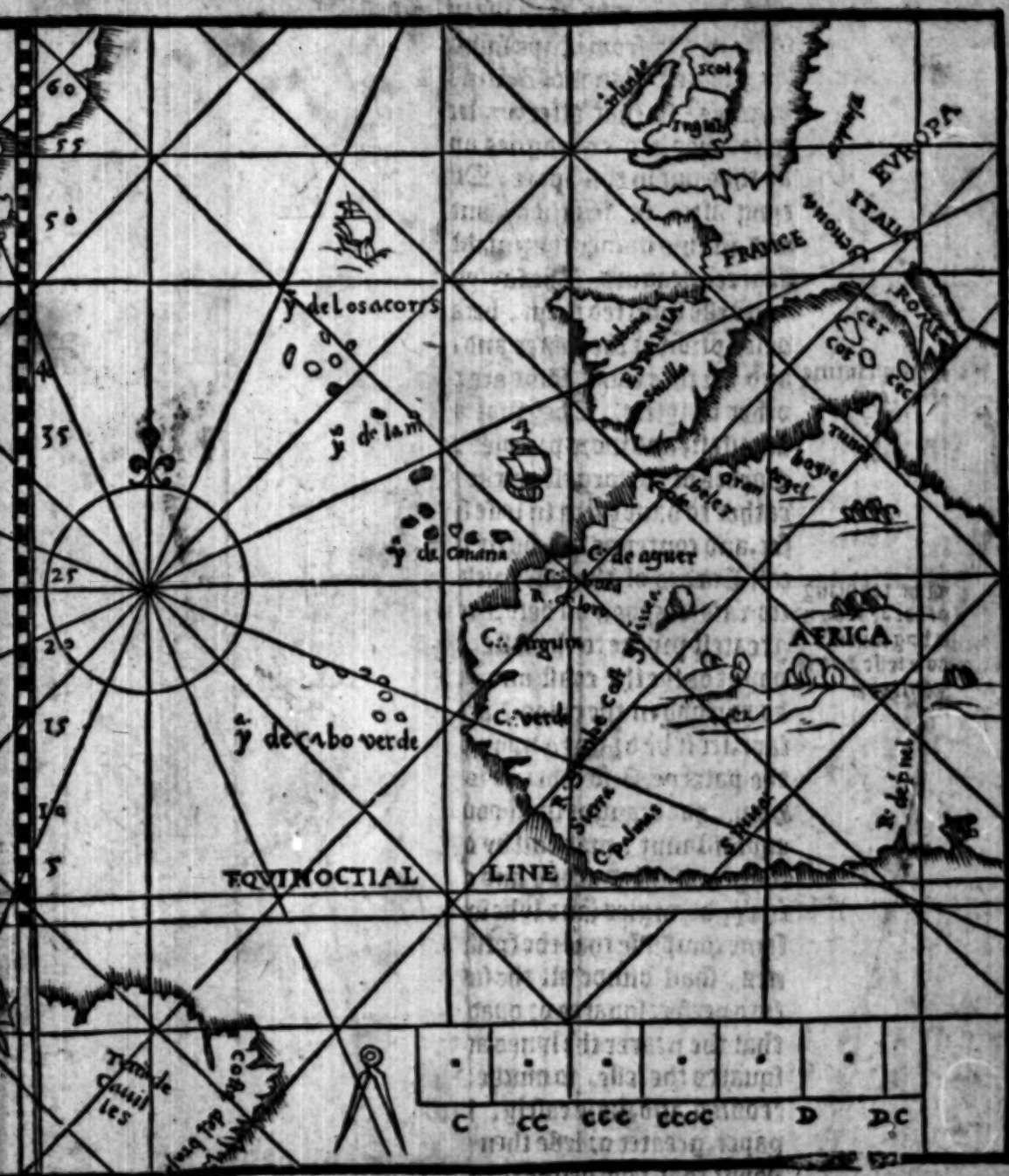
The thirde part,  
 Here foloweth the manner of translatyng  
 the Carde from one fourme into another,  
 greater or lesse.

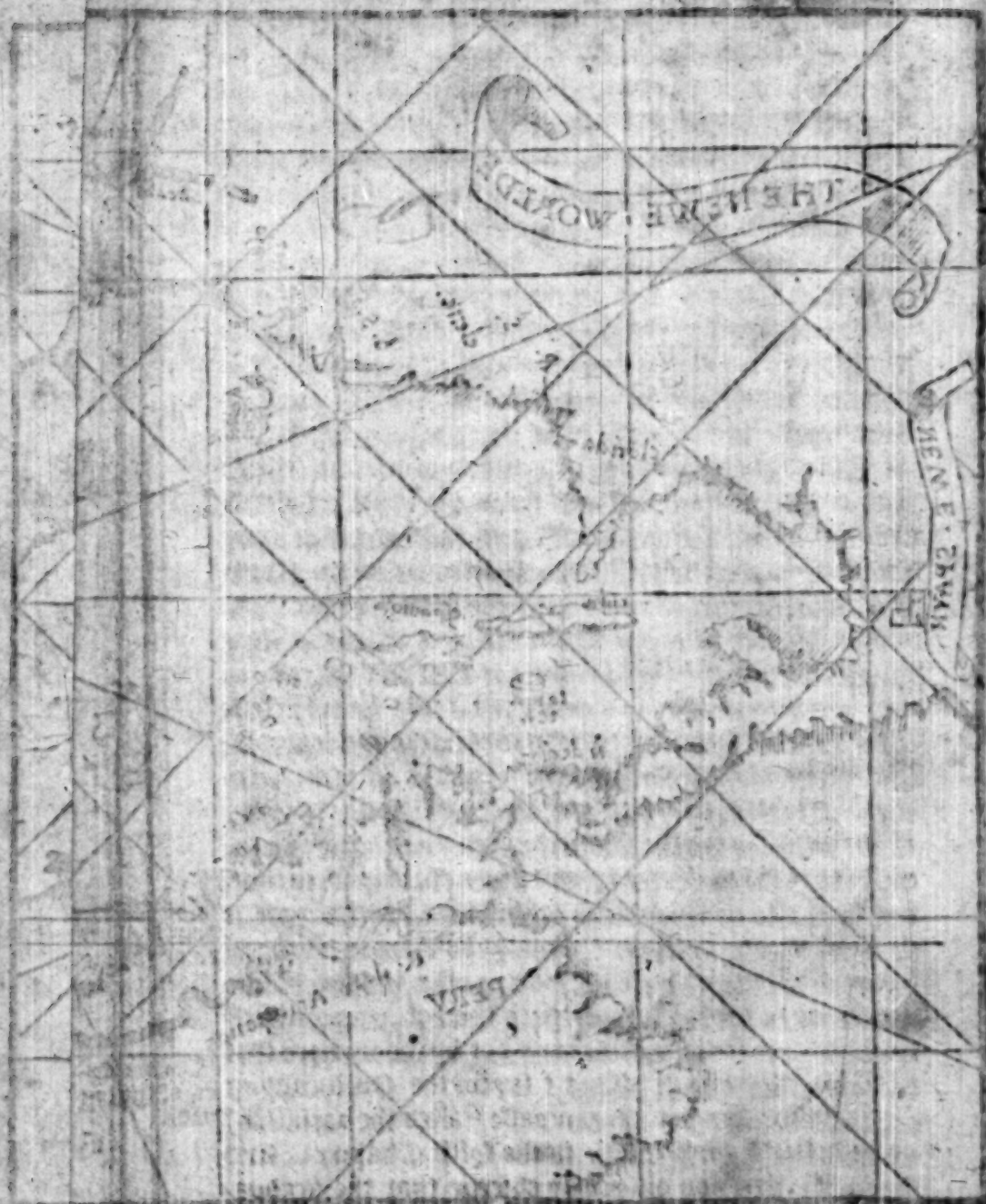


Here foloweth a similitude of the Ma-  
 ryners Carde.









THE NEW WORLD  
NEW E. SPAIN  
THE NEW WORLD  
NEW E. SPAIN

The Pilottes and Maryners neyther vse nor haue the knowledge to vse other Cardes, then onely these that are playne, as I haue sayde. The whiche, because they are not Globus, Sphericall, or rounde, are imperfecte, and sayle to shewe the true distaunces. For in howe muche they departe from the Equinoctiall, toward which so euer of the Poles, the Peridian lynnes are contracte narrower and narrower: In suche manner, that yf two Cities or poyntes in the Equinoctiall, shoulde be distaunt of longitude. 60. leagues, and in the selfe same Peridians at 60. degrees from the Equinoctiall, towardes eyther of the Poles, shoulde be other two Cities or poyntes, they shoulde be distaunt in longitude but onely. 30. leagues. And for the better declaration and vnderstanding hereof, I say, that if two Shippes shoulde departe from the Equinoctiall, the one distaunt from the other a hundred leagues by East and West, and that eyther of them shoulde sayle directly by his Peridian towardes the North: then when eyther of them hath the Pole ouer his Horizon. 60. degrees, the one shalbe distaunt from the other onely. 50. leagues by the Parallele of East and West: as appeareth by the playne Cardes, that they haue the selfe same hundred leagues. And besyde these considerations, one errour byngeth in an other: and so an other another. Whereof to speake any moze here, it shalbe to certayne Pilottes (as the Proverbe sayth) not onely to geue musicke to the deafe, or to paynt a house for blynde menne, but shal also be an endlesse confusion. Furthermoze, it is necessarie to consyder, that good Cardes ought to haue the Coastes, Portes, Cities, & other places, situate accordyng to the wyndes or lynnes thereof, proportionally as they are in the worlde; and not by the wyndes that the compasse sheweth. This I say for the Northeastlyng or Northweastlyng of the compasse (called the variati- on) as hereafter I wyll touche in the fift Chapter. And lykewyse shall you diligently obserue, that the graduation of the Carde shewe the same in theyr proper altitudes. The Cardes that lacke this, ought to be corrected and amended by wyse and expert menne: Sauyng that

The playne Cardes are imperfecte.

Example of errour in the playne cardes.

The ignorance of certayne Pilotes. Good cardes.

The variation of the compasse.

Altitudes.

## The thirde parte.

In the narrow  
seas they sayle  
not by the ele-  
uation of the  
Pole.

Correction of  
the sea carde.

The weast  
Indies.

Charles the  
fifth.

that in the Lenant sea (called Maræ Mediterraneum) and  
in the Chamell of Flaunders (called the narrow seas) it  
is not inconuenient for the Navigation, that the Portes  
be marked in the Cardes by the wyndes, whiche the  
Compass sheweth, so; as muche as they sayle not by the  
altitudes of the Pole. Lyke wyse, it shall not be incon-  
uenient, but rather very necessarie (to auoyde so manye  
errours, of the whiche doo flowe greate daungers, and  
suche a confusion) that your Maiestie shoulde commaund  
certayne learned Cosmographers, and expert in the arte  
of saylyng, to verifie the altitudes of the Pole, that are  
of Portes, Capes, Ilandes, and people by the coastes  
of the Sea, and in lyke manner truely to describe the  
coastes of the lande, especiall ye of the Navigation of  
the West Indies, or Mundo Nuevo, where it hath plea-  
sed God that so manye nations and people haue receaued  
the water of holy baptisme, comyng to the knowledge  
of the true God, whereby the Christian Emprre is  
greatly amplified, besyde the greate rycheffe had by the  
sayde Indies. And this hath God miraculously wrought  
by the conquestes of your Maiestie, in subduyng infidels,  
and Gentiles, to the obedience of the true Catholique  
fayth. Whereby, not onely God hath ben well pleased,  
but also your Maiestie hath receaued perpetual fame, with  
eternall renowne, and immortall glory to your posteritie  
in woordes to come.

### The.iii. Chapter, of the vertue and propertie of the Lode stone, called in Latin, Magnes, and in Spanish, Piedrayman.

The



**T**he Lode stone (as wyrteth Cardinall Cusanus) hath substaunce, vertue, and operation. His vertue is engendred of his substaunce, essence, or beyng, and of his essence and vertue proceedeth his operation and effect, in such sorte, that this stone communicating his vertue to Iron, by reason thereof, causeth the Iron to moue, although betwene the one and the other be a cuppe, or plate of syluer, or a table, or any other lyke thyng.

The attractiue, or drawyng force of the Lode stone, causeth the nature of Iron to be, and reste in it, and that so firmly and quietly, that beyng naturally heauye and ponderous, it descendeth not, because his nature resteth not in hym selfe, but is vnite with the nature of the stone, whiche seemeth to extende it selfe, and as it were to caste forth a lyuely spirite of enchaunting vertue. Inso much that (as we see by experience) by the sayde vnion, it not only distributeth his vertue to one Iron, but that Iron lykelypse to another, and that other agayne to another: and so forth, vntill of many ringes, or lynkes of Iron, be made a chayne.

Saint Augustine (as he wyrteth in his booke, De Ciuitate dei) dyd marueyle that he sawe an Iron moue it selfe vppon a vessell, by mouyng the Lode stone vnder the vessell.

It is called Magnes, because the inuentour, or sender thereof was so named: who (as Plinie wyrteth) keeping cattell in East India, had his shoes soled with plates of Iron, and Iron nayles, suche as they vse in Castonie, and had in his hand a staffe with a pyke, or hoke of Iron: and resting hym selfe vppon a quantitie of this stone, coude not remooue his feete, neyther lyst by his staffe. When staying a while astonyshe, as ignorant of the cause, at the length began to perceane the propertie of the stone, and to vnderstande the attractiue vertue thereof, (the colour of it differeth not from Iron) and was therefore called quicke Iron, or lyuing Iron.

The vertue, substaunce, and operation of the Lode stone.

Vertue attractive.

Cusan applyeth this to the glorified body of Christ, according to these wordes. If I shalbe exalted, I wyl drawe all vnto me.

Why the Lode stone was called Magnes, and the synging thereof.

## The first part.

**Sundrye  
kynedes of the  
lode stons.**

The best kynde of these stons, is of Azurine, o; blew colour, as the Sea sometymes appeareth.

Of these, are founde fyue kyndes o; differences. The first is, of Ethiopie. The second, of Macedonie. The third, of Lechio in Boecia. The fourth, of Troada, neare to Alexandria. And the fifth of Asia. But at this day, it is found in dyuers other places. It is founde also in many places in Spayne: as in the hyl Morena, neare vnto the village of Calera, beyng of the order of saint James, in the prouince of Leon. Lykewys in a hyl of Moron, in the territoie of the Erle of Vrenia, is great quantitie there-

**The Ilande  
of Elua.**

**The lode  
stone of Den-  
marke.**

**The lode  
stone of Ethi-  
ope.**

**Diuers opini-  
ons of the lode  
stone.**

**The qualities  
and properties  
of the lode  
stone.**

of, and in diuers other places. The stone that we most co-  
monly vse, is of y<sup>e</sup> Ilande of Elua, of the Lord of Pomblina,  
which Iudge to be better then that of Denmarke. This  
and the other, haue vertue to drawe yron vnto them. And  
trewe it is that Teanxedes writeth, that in Ethiopie is  
found an other kynde of this stone, that putteth yron from  
it. Auerroes the commentator of Aristotle, denieth that  
Magnes draweth iron vnto it, but sayth, that iron by his  
naturall inclination, both moue to the stone, as to his na-  
tural place, by a certayne qualitie, which the stone impres-  
seth in iron. And besyde this vertue and propertie that it  
hath to drawe iron vnto it, it hath also another: and that  
is, that it geneth vnto iron vertue and polure, to shewe  
the two pointes of the Horizon, where it cutteth the Meri-  
dian; that is in the two wyndes, of North, and South.

**The partes of  
the lode stone.**

These vertues are found moxe intent, in only two partes  
of the stone: and these are euer opposite, o; contrary the  
one to the other, and so are they contrarie in operation.  
For iron touched with the one part, and placed where it  
may moue freely, will shewe the North: and an other  
iron touched with the other part, will shew the South.  
Fyndyng this experiance, may be knowen, what part of  
the stone answereth to the North, which the Mariners  
call the face of the stone, and lykewys of the South.

**what part of  
the stone an-  
swereth to the  
North, and  
South.**

This stone is so necessary, that without it, Na-  
uigation shoulde be imperfecte and vncertayne, be-  
cause it geneth life to the needle and compasse, which  
leadeth and guydeth the Pilotte, that he may go certayne-  
ly in

ly in the day, and not erre or wander in the nyght. Also it sheweth and directeth to compasse the worlde, and to knowe the wyndes. And therfore, for asmuch as the compasse is so necessarie, we intend to shew the order and manner howe it ought to be made, for it maye chaunce to faile, or be lost in the viage.

The.iiii. Chapter, of the makynge  
of the Wapyners compasse for  
Navigation.



Take suche paste of paper, where of Cardes are made, and make in it a Circle, of the quantite of a spanne, or litle more or lesse. In the whiche you shall paynte the 32. wyndes, with theyr colours, in suche order as we gave in the firste and seconde Chapter of the wyndes, and of the Carde, not forgetting to marke the North with a floure deluce, and the East with a crosse. And more then this, may every man garnishe and beautifie the same, as seemeth best to his phantasie. Then on the lower or nether part of this paste, you must drawe a lyne, which shalbe directly vnder that of the North and South: whiche shalbe the marke for the setting of the Irons and Steeles. Then shall you take wyre of iron or Steele, of the byggenesse of a greate pynne, or accordyng to the byggenesse of the roundenesse of the paste, floure, rose, or syle, as it maye be called. This wyre muste be bowed double, so that enerye of the partes may be equally as long as the Diameter of the syle, and a quarter parte more. The endes or poyntes of these irons or steeles, muste be pinched togeather, and made close, and open in the myddest, the one from the other, vntyll the edges come to be equall with the extremities of the Diameter of the syle, and so shall the steeles remayne in manner in fourme of an egge. These wyres or irons muste be made faste in

The vse and  
makynge of the  
Wapyners  
compasse.

The floure de-  
luxe, and the  
crosse.

The syle,  
floure, or rose  
of the com-  
passe.

## The thirde parte.

**The lyne of  
the North  
and South.**

**The touching  
of the needle  
with the lode  
stone.**

**The breaking  
of the stone, to  
drawe out his  
vertue.**

**The bore of  
the compasse.**

the neather parte of the sye: so that thery extremities, ends, or poyntes, come precisely by the lyne of North and South. And to fyre or fasten them so, they must be covered with a thynne paper glued, leauyng the poyntes and ends vncouered: And these ends must be touched with the Lode stone in this manner. The parte that is vnder the floure deluce, must be rubbed on that part of the stone that anny weareth to the North, as is sayde in the Chapter before. And this shall suffice for the perfection of y<sup>e</sup> compasse. Yet some there be, that for superaboundaunce, doo touche the other part of the Iron, with that part of the stone that anny weareth to the South, although it maye suffice to touche it onely with the other parte. This touching of the Iron with the stone, that the demonstratine or woooyng vertue may shewe it selfe forth, must be donne with geauyng certayne strokes with a hammer, on that parte of the stone wherewith the Iron must be touched, that is to say, in the North part, or the South. And from these wyl come forth of the stone, certayne beardes, like smal pycles, whercon you shall rubbe the poynt of the Iron, as you woulde whet a knyfe: and so shall certayne of those beardes of the stone, cleane and sticke faste to the Iron. And the Iron thus touched, with y<sup>e</sup> beardes cleauyng to them, you must take a pycke or poynt of laton of Pyramidall, sharpe, or keeple fourme, which is broad below, and sharp above toward the poynt. This is made round, or egypt square, as seemeth beste. And in the neather parte or breadth, it must be bozed (but not throughe) with a bozer, whiche must also be of Pyramidall fourme, and enter into the myddell of the sayde Pyramidall pycke or poynte of laton, vnto the myddell, or some what more. This Pyramidall poynt (whiche the Maryners call the Capistell) must be of heygth halfe a finger breadth, or accordyng as the compasse shalbe, and must be put throughe the center of the sye, so that the poynt come forth on the hygher parte thereof, and must there be made faste and well fyete. When shall you take a rounde bore of wood, within the whiche the needle maye be, not touching the sydes of the same: And this must be of the heygth of the

the halfe Diameter of the compasse. And the grounde of  
 bottome therof must be set to it, as the couerping of a bore,  
 that it may be easely taken of, and put on, to haue often re-  
 course, to touche the yrons with the stone, (whiche they  
 call seedyng) when neede shalbe, that the vertue of the  
 compasse fayle not. Also in the myddest of the grounde,  
 or so wyde of the bore, you must set a sharpe poynt or prycke  
 made of a wyre of laton: This must stande ryght by And  
 vpon the prycke or poynt thereof, you shall set the bozed  
 boale of the Capitel. And that the wynde enter not aboue,  
 you shall cover the bore with a glasse. And thus beyng  
 touched with the stone, and set vpon the poynt, it shall  
 shewe the true part of the North, and consequently al the  
 other wyndes.

Seedyng the  
 needle with  
 the stone.

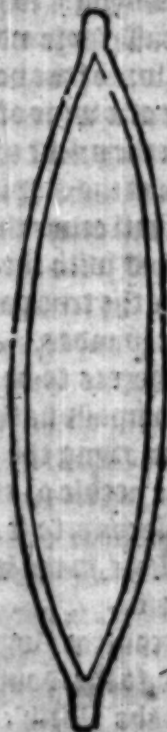
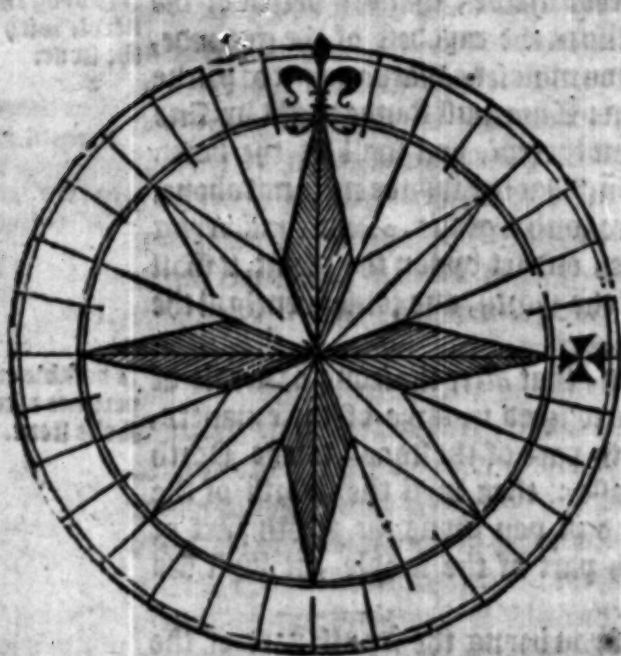
And here is to be noted, that after the irons or needle of  
 the compasse hath ben touched in anye of these maners,  
 yf you bryng the North part of the stone, to the North  
 of the needle or compasse: then wyll the North of the  
 needle come to it. And yf you bryng the South part of  
 the stone, to the South part of the needle, it wyll flee  
 from it.

A notable ex-  
 perience of the  
 Load stone.

And contrary wyse, yf you bryng the South part of the  
 stone, to the South of the needle, it wyll come to it: and  
 yf to the North, it wyll flee from it. This is vnder-  
 stood, the needle or compasse standyng as it shoulde be.  
 And this also is a good signe, to know which is the North  
 part, and South part of the stone.

Moreover, this bore must be put within another bore,  
 in the whiche it must hang vpon two circles of laton, an-  
 nered the one within the other: which serue that the com-  
 passe waye not, or hang not towarde the one syde or the  
 other, although the shippe swaye. And this bore also must  
 haue his couer of woodde, to keepe the other. You shal  
 lykelwyse obserue that the poynt of the Capittel, and the  
 hoale thereof, and also the poynt or prycke vpon the which  
 it resteth, be vpryght, and lykelwyse the Rose, that it de-  
 cline not to one part or other. And yf it be quicker then it  
 ought to be, then make the poynt that it goeth vpon,  
 somewhat blunter.

# The thirde parte.



\* The .v. Chapter, of the effect or propertie,  
that the compasse hath to Northeasting,  
or Southwesting, whereby is known  
the variation of the compasse.

The variati-  
on of the com-  
passe.



Any and diuers are the opinions that  
I haue hearde, & also read in certayne  
wyters of later dayes, as touchyng  
the Northeasting, and Southwesting  
of the compasse, and yet me see-  
meth that none doeth touche the  
pricke, and seue the whyte. They  
call it Northeastynge, when the  
needle

needles sheweth o; poynteth from the North (whiche is his true marke) towarde the North-east: and North-westing, when from the North, it declyneth toward North-west. For the better understanding of these differences, whereby the needles differ o; varie from the Pole, you must (beyng in the Meridian where the compasses shewe the Pole) imagin a poynt vnder the Pole of the worlde, and this poynt to be without all the heauens conteyned vnder the fyrst moueable. The whiche poynt o; part of heauen, hath a vertue attractiue, that draweth vnto it Iron touched with the part of the lode stone, correspondent to that certayne part of heauen imagined without o; vnder all the heauens, moued by the fyrst moueable. For yf it were imagined to be moued within any of the moued heauens, then the attractiue poynt, by the mouing of the fyrst moueable, and consequently the compass, should make the selfe same mouing in .24. houres: whiche is neuer seene. And therefore this poynt is not in the moueable heauens, neyther in the Pole. For if it were in it, the compass should not varie, North-easting, & North-westing. Therefore the cause of North-easting, o; North-westing, o; departyng from the Pole of the worlde, is, that beyng in the sayd Meridian, the attractiue point and the pole, are in the selfe same, o; in one Meridian: and the compass shewing the attractiue poynt, sheweth directly the pole. And departyng from the same Meridian toward the East (the worlde beyng rounde) the pole of the worlde remaineth to vs on the left hande: and the poynt of the attractiue vertue, shalbe on the ryght hand, which is towarde the North-east wynde. And in howe muche moze we shall sayle towarde the East, the distaunce shall appeare greater vnto vs, vntyl we come vnto the .90. degrees: and there shalbe the mosse and greatest North-easting. And passyng from thence further forthwarde, it shall appeare vnto vs, that the attractiue poynt, commeth nearer and nearer vnto the Meridian lyne: and so muche shall the compass go betteryng o; amending the North-easting, vntyl it returne to the selfe same Meridian in the opposite o; contrarie part from whence they came,

The poynt attractiue is imagined vnder the pole of the worlde.

The cause of the variation of the compass.

Departyng of the pole from the poynt attractiue.

The greatest North-easting.

## The thirde part.

or where they began, and then shall the attractive point  
 be to them directly vpon, or agaynst the pole of the world,  
 and the compasse shall shewe, or poynt directly towarde  
 it. And agayne, passyng further forwarde, the pole of the  
 world shall remayne to the ryght hande, and the poynt  
 attractive to the lefte hande, and so shall the compasse  
 begynne Northwesterlyng, increasyng it vntyl it comme  
 from thence to the .90. degrees, and there shalbe the  
 moste of his Northwesterlyng. For turning towarde  
 the Meridian from the attractive poynt, it shall go ameyn-  
 dyng or betteryng, vntyll it returne to the selfe same  
 Meridian from whence it departed, and there shall the  
 compasse shewe the pole of the world directly, by, or ouer  
 agaynst the attractive poynt, whiche is perpendicularly  
 vnder the pole. And yf from thence they should turne, to  
 passe towarde the West, the pole should rest to the right  
 hande, and the attractive poynt to the lefte, and so shall  
 the variation be to the Northwe: and this is the cause of  
 the Northeastlyng, and Northwesterlyng, or variation of the  
 compasse. Also it is not to be vnderstode, that this North-  
 eastlyng, and Northwesterlyng, is vniforme, as is the depar-  
 tyng (or accor dyng to the departure) from the Meridian,  
 where the compasse sheweth perfectly: but rather besoze,  
 at the begynnyng of the departyng from the sayde Meri-  
 dian, it maketh difference, or variatiō in a certayne quan-  
 tity, and the increase that is afterwarde, is little, and  
 so much the lesse, in howe muche the more the departing  
 is from the sayde Meridian. For it is a passion of circles,  
 diuidyng or cutting them selues in the sphere. So that  
 these differences are, as are they of the declinations of  
 the Sunne: whiche neare vnto the Equinoctials, are  
 great, and neare to the Solstitials, are litle. All the which  
 shall euidently appeare in the figure folowynge, which is  
 a circle diuided by two Diameters, into foure equal par-  
 tes, cutting them selues in the center in ryght angles.  
 And from the center poynt (called the pole) com meth so:th  
 a moueable Meridian: and in it goeth a compasse lyke  
 wyse moueable about the circle. The attractive poynt is  
 somewhat distant from the pole of the world, and from  
 it com meth

The greatest  
 Northwe-  
 sterlyng.

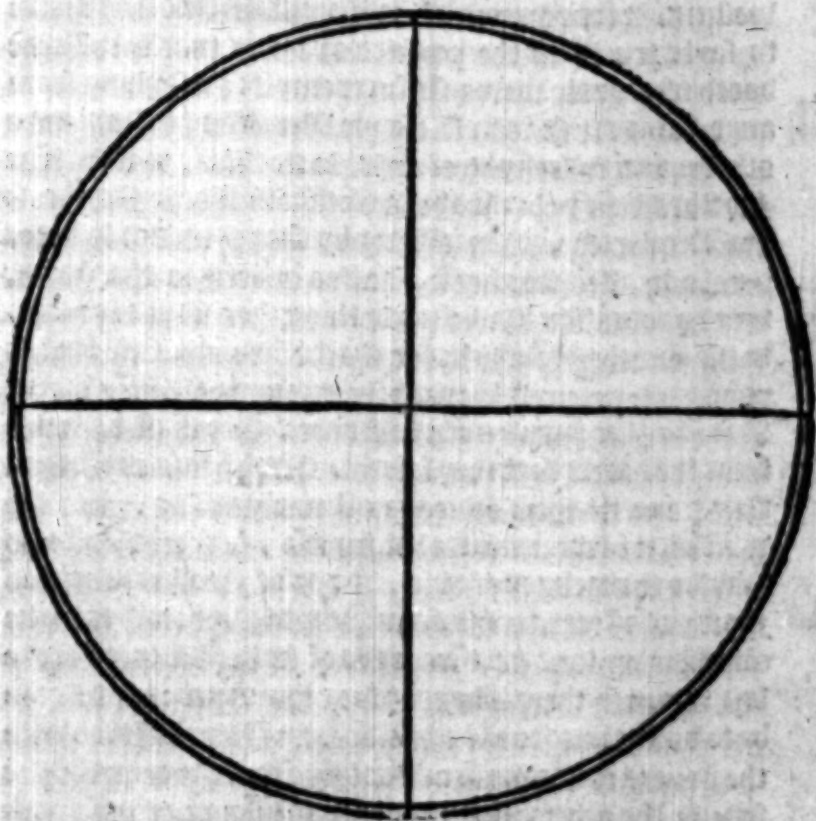
The attrar-  
 tive poynt is  
 vnder the pole.

The North-  
 eastlyng and  
 Northwe-  
 sterlyng is not  
 vniforme.

The declinati-  
 on of the  
 Sunne.

st, commeth soorth a threede, which must euer passe by the North and South of the Compasse. And the Compasse being in the Meridian of the poynt attractiue, that passeth by the Pole, shal shewe the Pole. And without that, shall goe Northeastlyng, or Northweastlyng, so varyng and departing from the true Meridian that commeth soorth of the Pole of the worle. It is the opinion of some Mariners, that the Meridian where the compasse sheweth directliye the Pole, passeth by the Iland of Sancta Maria, and other the Pole, say, by the Ilande of Cuervo in the Afores.

### Demonstration of Northeastlyng.



And where as the inconuenience is manifest and notorious, the same must be remedged with prudence & tyme, and not to be negligent in the byage: but euer to vse and obserue experience, moze profitable then the subtilis

Experience,  
the ground of  
reason.

## The chird parte.

**Aduertisemēt to Pilottes.** and curious questions of the secreete searchers of naturall

thynges without experience, whereof reason taketh his principall grounde. And therefore, the wyle Pilot ought to knowe by experience, (as many of them doo not) howe muche a good Compasse dooth varie, Northeast, or Northweasting from one Porte to an other. So that to knowe how much y<sup>e</sup> Compasse dooth varie, Northeast, or Northweasting, from one place to another (as to say, halfe a quarter, or moze or lesse in quantitie as they are disaunt from the sayde Meridian, where the Compasses shewe the Pole) shal in the nauigation take heede, & well consider, in any such viage, the Northeast, or Northweasting, in the poyntes of the Compasse. And this shalbe to sayle truely by the poyntes or lynes that the Carde dooth certaynely shewe. As for example: In saylyng from anye Ilande that is in the sayde Meridian, or from anye other parte, in seekyng of anye Porte that is to them true Northeast, if by this way the Compasse should Northeast halfe a quarter, then saylyng by the poyntes or lynes of the Compasse Northeast, halfe a quarter to the North, they<sup>e</sup> nauigation shalbe (excepting other impedimentes) to the Northeast, whiche the Carde sheweth. And by this poynt or lyne, must be made the accompte of such a viage. And so by the poyntes of the Carde, they shall directely finde the Porte that they sought. And by this order shall they governe them selues in all nauigations. For the whiche, it is conuenient that wyle and experte Pilottes shoulde make notes of obseruations of Northeast and Northweasting, that is, from Port to Port, and to make compilations and geatherynge of suche Notes, to carye with them in they<sup>e</sup> Shyppes for regimentes: and not to be to busie or curious to amende they<sup>e</sup> Compasses, or with the stone to rubbe the Irons or Steeles, neither on the one syde or the other, from whence the floure deluce dooth shewe: For this should cause many inconueniencies. Neyther ought they to admitte in they<sup>e</sup> Cardes, two graduations: especially for that to knowe howe muche in euery place the Compasse dooth goe aside, or varie from the true Meridian, maye easely be made an instrument to shewe the

**Example of saylyng.**

**The variation of the compasse**

the same by the Sunne in the day, and by the Starres in the nyght.

✱ The. vi. Chapter, of the introduction and principles of the Arte of Navigation.



**E** As muche as nowe we haue the guide, which is the compasse, it is conuenient to enter into the way, which is Nauigation. The which (as we haue sayde) is to go or passe by water from one place to another. And this presupposed, I say, that he that desyeth to attempt Nauigations, must knowe two thynges, which the Carde shall shewe hym. The one is, by what poynt or lyne he ought to sayle: and this shall the lynnes of the sayling Carde shewe hym. The other is, the leagues of the distaunce: and this shall the scale or trunke of the leagues shewe, taking with a compasse the distaunce of two places, and applying it to the scale. The knowledge of these two thynges, ought the Pylote to beare in memoery: and to put them in effect, ought to direct his foze hyppeto the selfe same wynde, whiche the compasse doth shewe. For the distaunce, he ought to knowe howe muche the shyppe goeth dayly: well considering and obseruyng the wyndes, tydes, currentes, and all suche thynges as may be with hym, or agaynst hym. And accoꝝyng hereunto, he shall knowe howe muche he hath gone, and what remaineth for hym to go, and whether he be farre of, or neare vnto the place whither he intendeth to sayle: the whiche in Nauigation, is the end desyzed. And because this estimation or computation can not be iust and exact, especially in a long vyage, or in long tyme, it shall be conuenient that we rectifie or amende it, knowyng the place where the shyppe is, on the superficial part of the water, by the place that aunswereth to it in heauen. This place of heauen, is knowne by the altitude of the pole: and by the altitude of the pole, is knowne the

In Nauigation, what is cheefely to be considered,

The distaunce,

The altitude of the pole and Equinoctiall.

## The third parte.

**The Meridian altitude.**

altitude of the Equinoctiall, and by the altitude of the Equinoctiall and declination of the Sunne, is knowne the Meridian altitude: and contrariwise, knowing the Meridian altitude, and declination of the Sunne, is knowne the altitude of the Equinoctiall, and by the Equinoctiall, the pole, and by the altitude of the pole, is knowne the latitude: and this is the place that is desired to be knowne. But so; as much as the heauen is moucable from the East to the West, this place is not knowne as a certayne poynnt, but is knowne as a lyne or paralele at a certaine distance from the Equinoctiall, and it is not knowne in what poynnt of this paralele the shyppe is, by the altitudes that are taken from heauen: but it is knowne by the lyne that the shyppe hath gone, as we will further declare in the xiii. Chapter, of making a poynnt or pricke in the Carde. And in this maner you shall haue rectified the way that the shyppe hath gone: and consequently the way that it hath yet to go.

**To know the place of heauē.**

**To know the way of the byage.**

**Rules to knowe the altitudes.**

**Longitude and latitude.**

**Variation of degrees.**

And so;asmuche as these altitudes are so profitable and necessary, it shalbe needefull to geue rules howe we may vse them to our moſte commoditie. And so; this, is presupposed to knowe, that all places situate on the superficiall part of the earth, and water, eyther they are vnder one Meridian, so that they haue, or where they haue one selfe same longitude, and differ in latitude, or are in one paralele where they haue one selfe same latitude, and differ in longitude, or are in diuers Meridians and paraleles, where they differ in longitude, and latitude. And I say, that yf they haue one selfe same longitude, they sayle from the one to the other, by the lyne of North, & South, and howe many degrees doeth varye the altitude of the pole, and of the Equinoctiall in heauen, so many degrees haue they gonne by Sea, or by lande. If two places haue one selfe same latitude, they passe from the one to the other by the lyne of East and West. And in suche maner of byage, the altitudes do not profite vs, because there is no variation. If they differ or varie in longitude, and latitude, they sayle from the one to the other by some of the other lynes. But there are moze degrees that correspond

responde to the way that the Sbypp maketh, then the degrees that varie the altitudes of the Equinoctial, and the Pole. And this difference shalbe greater, in howe much the lyne shal beare neare to East and West: And how much it shal beare neare to North and South, it shal be lesse. Of the degrees or leagues that aunswere to euery degree of the variation of the altitude, we wyl entreate hereafter in the xii. Chapter.

These altitudes are knowen manye wayes: but especially by two: as, by the Meridian altitude and declination of the sunne (as we haue sayde) is knowen the altitude of the Equinoctial: and by it, the altitude of the Pole. The seconde waye, they are knowen by the altitude of some fyrte starre of those that are not hydde. And among manye other, the North Starre is taken, because

Howe the altitudes are knowen.

The fyrte starres.

The North starre.

To knowe the altitudes by the sunne. The Meridian altitude,

it is nearest to the Pole. To knowe the altitudes by the Sunne, thre thynges are necessarie, that is to saye, an instrument, the declination of the Sunne, and rules. The instruments to knowe the Meridian altitude, shalbe the Astrolabe, because it is moste commodious for this purpose, whereof we wyl entreate in the Chapter following. The declination of the Sunne, (whiche is to take it a waye, or to loyue it with the Meridian altitude,) we haue already described in the thyrde Chapter of the seconde parte. The rules to knowe when the declinations must be loyued with the Meridian altitude, or taken from it, we wyl geue in the viii. Chapter. To knowe the altitudes of the Pole, by the altitudes of the North starre, two thynges are necessarie: that is, an instrumente, and rules. The instrument wherewith the Paryners are accustomed to take the altitudes of the North, they call Balestilia, whiche is a crosse staffe, whereof

The declination of the sunne.

The altitudes of the Pole.

we wyl wyte hereafter in the nyth Chapter.

Jacobs staffe.

And the rules of the Turne or Compass, which the North Starre maketh about the Pole, we wyl declare in the tenth

Chapter.

I III

The

# The thirde part.

## The.vii. Chapter, of the making and vse of the Astrolabie, with the whiche the Mariners take the altitude of the Sunne.



Take a plate of copper, or laton, (which for this purpose is better then any other metal) of the bignesse that you desire to make the Astrolabie, & is commonly of the bignesse of a spanne the Diameter, and let it be of the thickenesse of halfe a synger at y least: for the waightier that it shal

be, so muche shal it be moze steadie to take the altitude. This plate must be made rounde by a circle, leauing comming forth of the circle a corner, in the whiche you shall put a ringe or handle with a hole, wherby you may hang the Astrolabie, by a threed or lyne to take the altitude. After it is thus made, with the ring or handle annexed thereto, make it bright, and smoothe, pulished on both sydes, & al of one equal thickenesse, that one side be not heauier then an other, which you shall trye in this manner: Hang the plate by the ring or hole that you haue made, and from the same hole hang a plomet of leade, fastened to a beere, or fine threed of silke. The Astrolabie thus hangyng, free, and at libertie with the plomet, yf then the threed fall vppon the center of the Astrolabie, it is well: but if the threed doo leane or swarue to the one side, or the other, from the center, then is that side thicker and heauier then the other, and must therefore be made thynner, vntyl the threed fall iustly vppon the center. This donne, make a circle vpon the sayde center, a litle within the circumference of the Astrolabie. Then drawe a Diameter from the center of the hole, in the whiche the ring or handle is, vnto the center of y Astrolabie, tranersing or ouerthwarting the whole Circle. And this shalbe called the lyne of the Zenith, or Verticall poynt: whiche also shall be cut with an other Diameter vpon the center, making right angles with it. And this Diameter shalbe called the Ho-  
rizon

Therectifying  
of the Astro-  
labie.

The threed  
and plomet.

The lynes  
verticall and  
horizontall.

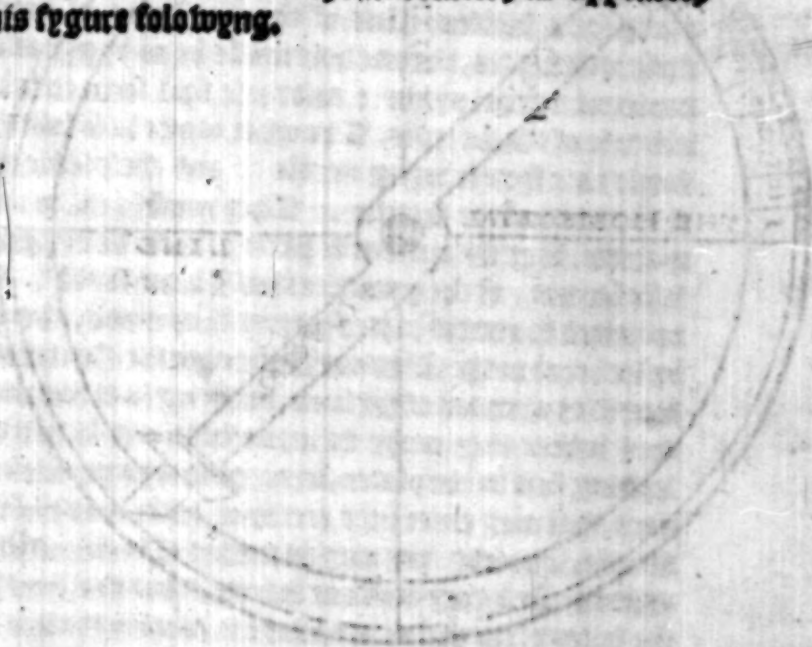
horizontall lyne. These two Diameters shall diuise the  
 Circle into foure equall partes. After this, you shall make  
 an other Circle, so much more within the second, that be-  
 tweene the circumferences of both the circles, may be con-  
 teyned the numbers of the degrees. When (the Astrola-  
 bie hangyng before you) you shall diuise the one parte  
 (beyng the superiour and least part) fyrst, into thre equal  
 partes, and euerye parte shall conteyne .30. degrees. Then  
 shall you diuise euerye parte of these into other thre e-  
 quall partes, and they shall conteyne 10. degrees: and  
 euerye of these diuise into two partes, and they shall con-  
 teyne .5. degrees. This donne, put a ruler vppon the cen-  
 ter of the Astrolabie, applyng it to euerye of the poyntes  
 that diuise the sayde partes, and drawe certayne lynes  
 that passe from the circumference of the firste Circle, vnto  
 the lesse circumference: and in the spaces of the lesse  
 Circle, wyte the numbers of the degrees, begynnynge  
 in the Horizontall lyne: and in that space put syue, and  
 in the seconde, tenne, and so forth of the other, vntyll  
 the .90. degrees ende in the lyne of the Zenith: then  
 shall you diuise the spaces that are betweene the fyrste  
 Circle and the seconde, euerye space into syue, whiche  
 shall make the .90. degrees. The Astrolabie thus made,  
 you shall make the Alhidada or Labell. For the whiche, The alhidada  
of the astrola-  
bie.  
 you shall take a plate of laton, of the breadth of scarcelye  
 two syngers, and as thicke as the Astrolabie: also, as  
 long as the Diameter of the Astrolabie, and make a line  
 in the myddell thereof, by the longitude: in the myddell  
 of this lyne, make a Circle so great, that it may touche in  
 the sydes of the plate: then cut of this plate on the one  
 syde, that which it hath from the lyne to the ryght hande:  
 and on the other side, that that it hath from the lyne to  
 the least hande, leauyng the Circle whole. This lyne that  
 shall passe by the center of the Circle, is called Linea fidu-  
 cia, (that is) the lyne of confidence: whiche is that, that  
 sheweth in the degrees, the altitude that is taken. When  
 shall you take away the endes or corners of the Alhidada  
 that are without the lyne, so that you touche not the lyne.  
 This donne, you shall make two lytle ryleng or rapled  
 tablettes

## The thirde parte.

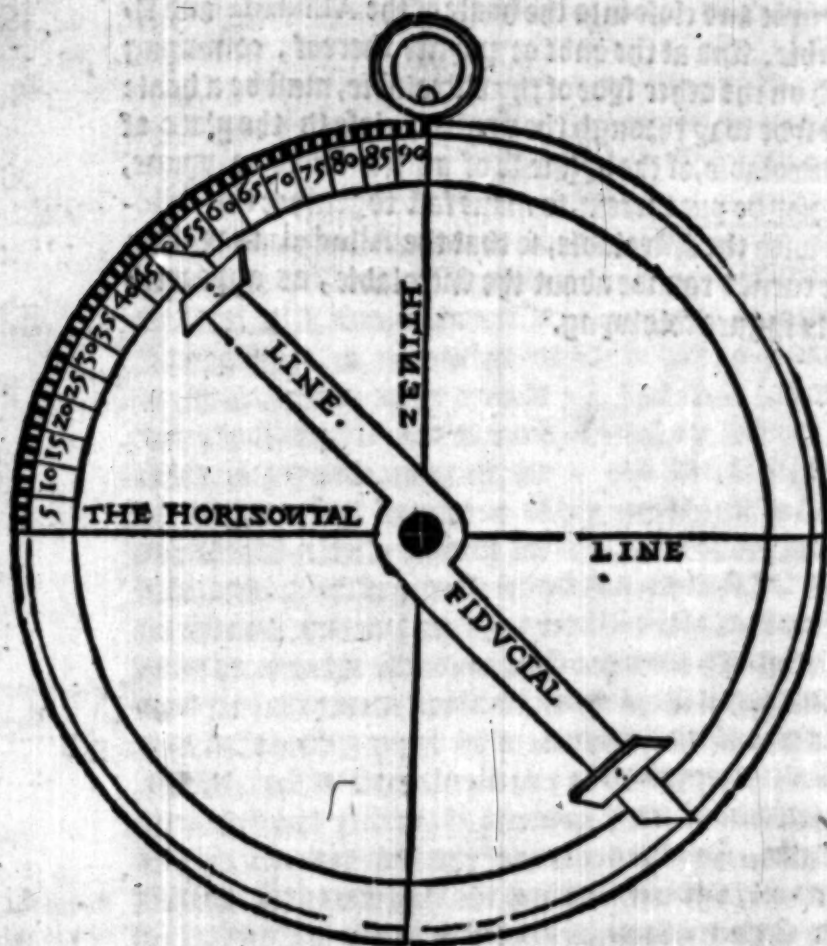
The holes of  
the Alhidada.

tablettes or plates of the same metall whereof the Astro-  
labie is made, and of the selfe same thickenesse that is the  
Alhidada, or litle lesse: and of the breadth of the Diamo-  
ter of the circle of the Alhidada. And let them be a thumbe  
in heighth or breadth. In the myddest of these two pla-  
ces, by the heighth, you shall make a lyne. When these  
are made equal, and al theyr angles ryght, in euery lyne  
of these that you haue made, you shall also make two ho-  
les, equally distant from the sides or edges of the sayde  
plates or tablettes. And of the two holes of euery of  
these litle plates, the one hole muste be as bygge as maye  
conteyne a great pynne: and these shall serue to take the  
altitude of the Starres. The other muste be so subtil and  
smale as a fyne sowng neede: and these serue to take  
the altitude of the Sunne. They must be made in suche  
manner, that the outwarde parte of them be bygger, and  
lesse within, of the quantitie that I haue sayde. These  
tablettes or erected plates being thus made, they muste  
be sothered in the Alhidada, betweene the Center and ex-  
tremities or endes of the same, making in it certayne not-  
ches where they maye be made faste, and sothered: or  
leaving first in the plates, certayne sharpe poyntes or cor-  
ners, that may enter into certayne holes made in the Al-  
hidada, whereby they may be made fast vnderneath with  
pyennes: And they muste be so sette, that the lyne where  
the holes of the plates are, maye fall vppon the line of con-  
fidence of the Alhidada: So that the one halfe of the plate  
be set vppon the Alhidada, and the other halfe without  
it, or at large. In lyke manner shall you take good aduer-  
tisement, that the greate hole of the one plate, stande di-  
rectly agaynst the great hole of the other plate, and be no-  
thing at al a wyse. This done, you shall boze the Astro-  
labie throughe by the Center, making a very rounde hole,  
that may haue in the mydd of it the Center of the Astro-  
labie. This hole shall be of the byggenesse of a Goose quyl.  
And the lyke shall you make in the Center of the Circle  
of the Alhidada. When shall you make a pynne or nayle  
of the same laton, the whiche on the upper parte of the  
Alhidada maye haue a playne and rounde head. This  
pinne

pyne also shalbe very rounde and smooth, that it maye enter iuste and close into the boale of the Alhidada and Astrolabie. And at the ende of poynthe thereof, commyng forth on the other syde of the Astrolabie, must be a boale made syde way thzough the pyne, close to the plate of the Astrolabie, of the bygnesse of a little nagle of pyne, that may be put therein, to make fast togeather the Alhidada with the Astrolabie, so that the Alhidada may thereby be turned rounde about the Astrolabie, as appeareth in this fygure folowng.



# The third part.



To take the  
altitude of the  
Sunne.

To take the altitude of the Sunne, hang by the Alhidada by the ring, and set the Alhidada agaynst the Sunne, and raise it, or put it downe in the quarter that is graduate, untill the beames of the Sunne enter in by the lyttle hoale of the tablet, or rayed plate, and precisely by the other lyttle hoale of the other tablet. Then looke vppon the lyne of confydence: and howe many degrees it sheweth in the quarter that is graduate) beginning from the Horizontal lyne) so many degrees of height hath the Sunne. In lyke maner shall you do to take the altitude of anye other Starre, looking through the great hoales,

holes, because this may hardly be seene by the lytle holes.

The.viii. Chapter, of the definition  
of the altitudes. And how the altitudes  
of the Pole may wel be knowen by  
the Meridian altitude & decli-  
nation of the Sunne.



It is conuenient to define the altitude, before we geue rules of the vse thereof. The Altitude of the Sunne, or the Moone, or of anye other Starre, is the distance that is betweene it and the Horizon. And this ought to be accompted by the degrees of the greater Circle, whiche passeth by the Zenith, and by the Center of the Sunne, or of the Moone, or of the Starre vnto the Horizon. And the degrees that are from the Horizon to the Starre, or to the Sunne, that is the altitude: And the degrees that are from the Center of the Starre, or of the Sunne, vnto the Zenith, is called the complement, or supplement of the altitude.

what is the altitude of the planets or starres.

The altitude of the Equinoctiall, is euer counted by the Meridian. And the degrees of the Meridian, that are betweene the Equinoctiall and the Horizon, is the altitude of the Equinoctiall: and other so many are they, that are from the Zenith to the Pole. For the altitude of the Equinoctiall, is equal to the complement of the altitude of the Pole. The degrees of the Meridian that are betweene the Equinoctiall & the Zenith, is called the complement of the altitude of the Equinoctiall, and is equal to the altitude of the Pole. And although we haue defined the altitude in generall, yet shal we only profite our selues by the Meridional altitude of the Sunne. The Meridian altitude, is the greatest altitude that the Sunne hath euerye day: and this shalbe, when the Center of the Sunne is in the Meridian. And the Arke of the Meridian, that is betweene the Horizon & the Sunne, is the Meridian altitude. So that when we say the altitude of the Sunne is taken, it

The complement of altitude.

From the Zenith to the pole

The Meridian an altitude of the Sunne.

is vnder.

## The third part.

**The shadowes that the sunne maketh at mydday.**

is vnderstoode at mydday. The shadowes that the Sunne then maketh, are in thre sortes. For either to vs it casteth the shadow toward the North parte, or toward the South, or perpendicular by a ryght vp lyne, so that at mydday, or noon, nothyng that standeth by ryght, geueth any shadowe at all. But for as muche as there is such variation in declinations, altitudes, shadowes, and paralles, it shalbe necessarie to geue rules for all variations. And these shalbe reduced into foure breefe and compendious rules: the whiche I haue here described, that the wyttie may take profite by them, and the rude learne them: not caryng for the rules of the Maryners, because they are to long and tedypous. For (as the Philosopher sayth) it is vayne to donne by many, that may wel be donne by fewe.

**Rules for all variations.**

**The perpendicular shadowe**

When the shadowe shalbe perpendicular, it is because the sunne is in the Zenith,  $\pm 90$ . degrees aboue the Horizon. And then how many degrees of declination the sunne hath, so muche shall we be distant from the Equinoctiall, toward the part where the sunne declineth. And yf it haue no declination, it and we shalbe vnder the Equinoctiall.

**The declining shadowes.**

But when the sunne and the shadowes shalbe to vs from the Equinoctiall, toward one of the Poles, we shall take away the declination from the meridian altitude, and then shall remayne the complement of the eleuation, whiche complement being taken from  $90$ . degrees, then shall remayne that whiche we be distant from the Equinoctiall, toward the same Pole.

When the sunne declyneth from the Equinoctiall, toward the one Pole, and the shadowes shalbe toward the other, we shall ioyne the declination with the Meridian altitude. And if al come not to  $90$ . then subtract them from  $90$ . degrees, and we shal haue the complement, & so muche shall we be distant from the Equinoctiall, toward that Pole to the whiche the shadowe falleth. And yf they be moe in number then  $90$ . then the ouerplus of  $90$ . shall we be distant from the Equinoctiall, toward the Pole, where the sunne declineth. And yf they be full  $90$ . we shalbe vnder the Equinoctiall.

When the Sunne hath no declination, we shalbe distant from

from the Equinoctiall the complement of  $\frac{1}{2}$  Meridian altitude, toward the pole where the shadowes are. By these rules (beside the vñe wherof we haue spoken) may be knowne how much is the greatest declination of the Sunne, the altitude of the Equinoctiall, the day, houre, & minute, when  $\frac{1}{2}$  Equinox was: the which is knowne as foloweth.

when the  
Sunne hath  
no declination

Haueing taken the greater Meridian altitude of the Sommer (whiche is in the beginning of Cancer) and the lesse of Wynter (whiche is in the beginning of Capricorne) taking away the lesse from the more, the rest is that, that is from Tropike to Tropike, and consequently parted by the myddest, is the greatest declination. As for example: I suppose, that being in the Citie of Cadiz, to fynde the greater Meridian altitude of the Sunne (being in the beginning of Cancer) to be .77. degrees, and the lesser Meridian altitude (which is, when the Sunne is in the beginning of Capricorne) to be .30. degrees, then taking .30. from .77. remaine .28. degrees: and so much is from Tropike to Tropike. And the halfe (whiche is .13. and a halfe) is the greatest declination.

To know the  
greatest decli-  
nation of the  
Sunne.

Example,

Consequently the greater declination added to the lesse Meridian altitude, or taking it away from the greater Meridian altitude, that yeldeth thereof is the altitude of the Equinoctiall. Example. 13. and a halfe of the greatest declination, ioyned with .30. of the least Meridian altitude, or taken away from the .77. of the greatest Meridian altitude, remaine .53. degrees and a halfe, whiche is the altitude of the Equinoctiall, in the Citie of Cadiz. Whereof it foloweth, that when we shall take the Meridian altitude in .53. degrees and a halfe, that day is the true Equinoctiall. But if one day it had lesse, and the other day folowynge it had more, we must take the lesse from the more, and fourme the rule of thre, vpon the rest, saying, If .24. minutes (which is that that the Sunne declineth in one day) doth yeeld .24. houre, how much shal those minutes that lacketh of .13. degrees and a halfe of the altitude of the Equinoctiall, yeeld mee Multipling and diuiding according to the foresayd rule, then that which cometh thereof, shalbe the houre after midday, when it is Equinox.

Example

The true Equinoctiall.

Example

### The thirde parte.

**Example.**

**E**xample of the experience that I made in the Citie of Cadiz the tenth day of Marche at midday or bygh noone. I toke the altitude of the Sunne, in .53. degrees and .26. minutes: they lacke to be the Equinoctial. 4. minutes. Another day, the .xi. of Marche, at noone, I toke the Sunne in .53. degrees, and .50. minutes: which are moze then the Equinoctiall by .20. minutes. Then to knowe at what houre the Sunne was in the .53. degrees, and .30. minutes of the Equinoctiall, I toke away the Peridian altitude that I toke at the tenth of Marche, from that that I toke at the .xi. whiche is the difference. 24. minutes, and I formed the rule, saying: yf .24. minutes the Sunne byd ryse to me, in .24. houres, then in howe much tyme shall ryse vnto me the .4. minutes that sayled me at the tenth of Marche: I multiplied, diuided, and founde that in foure houres: and so shall you say, that the Equinoctiall was in the citie of Cadiz the tenth day of Marche, at foure of the clocke at after noone: Whiche is vnderstood (accozdyng to the Astronomers) at foure houres runne at the .xi. day of Marche, at this present yeere. 1545.

### ¶ The .ix. Chapter, of the makying of the Crosse staffe, wherewith the Mariners take the Altitude of the Poorth Starre.

**M**ake a square staffe or yarde, of the thyn-  
nesse of a synger, moze or lesse, accozdyng  
to the goodnesse of the wood, and of length  
syre spannes or moze. For the longer that  
it is, the moze pzeise shal it be, and the de-  
grees shalbe y greater, wherby foloweth  
the certayntie of the Altitude. Then take a very playne  
table, of the length of the staffe, and two spannes of  
breadth, or at the least a spanne and a halfe: and in the  
myddest of this table, make a ryght lyne by longitude,  
and in the one ende of this lyne, make an other lyne that  
may cut it in ryght angles. And vpon the cutting of these  
two

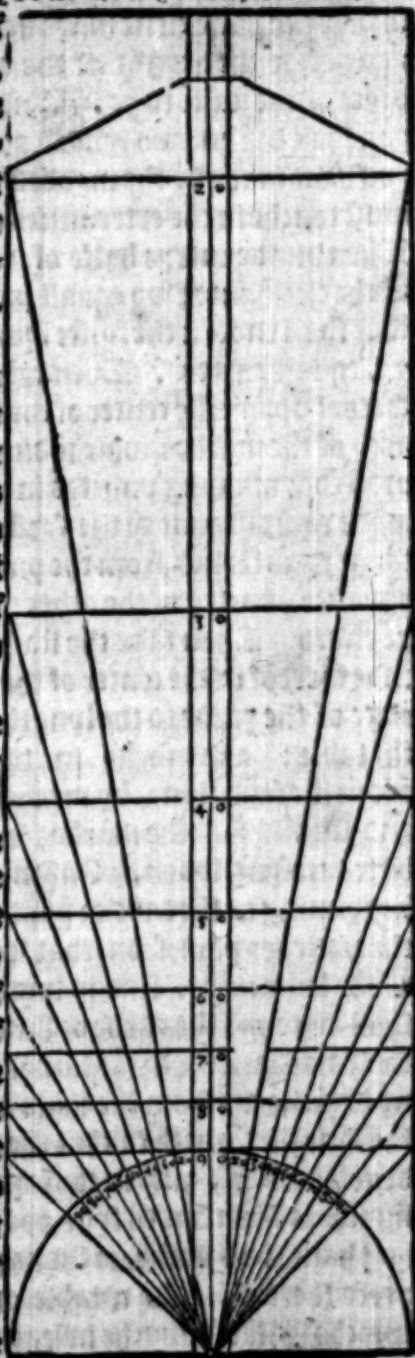
two lynnes, put the foote of the compasse, and make halfe a circle, which may remayne on the part of the long lyne, so that the halfe circle maye haue so muche Diameter, as you desire the heyght of the Hammer, heade, or crossepeece of the staffe to be. This halfe circle beyng made, you shall drawe two lynnes, equidistant to the line which you haue made by the myddell of the Table. These lines must touche in the extremities or endes of the halfe circle. Then diuide euery halfe of the halfe circle, or quarter of the circle, into two equall partes, and the two halfes that shall ende in the syffe lyne, diuide eche of them into 90. equall partes. Then take a ruler, and put the edge thereof vppon the center of the halfe circle, and vppon euery of the markes whiche diuide the 90. partes: and so procede, making punctes in the lynnes, whiche you haue made equidistant to the syffe lyne. Then drawe certayne ryght lynnes, from the punctes of the one lyne, to the opposite punctes of the other: and so shall the draught be ended. Then take the staffe or yarde, and put the one ende thereof in the center of the halfe circle, and apply the edge of the yarde to the lyne that goeth by the myddell of the table: and marke in the yarde the markes that are in the sayde lyne, by meanes of the trauersyng lynnes, and see also that the markes which you make in the yarde, be trauersyng lynnes. And make them theyr numbers, beginning at the ende or poynt of the yarde that shalbe to the contrary part, from that whiche you byd in the punct of the halfe circle. And to knowe with what degrees you shall begynne the yarde or staffe, and what number you shall marke in the syffe line of the punct, looke howe many degrees are from the circle which you diuided betwene the lyne that goeth to the laste marke, and with so many degrees enter, and so consequentye shall you place the numbers from sine to syne, or from terme to terme. When you haue thus numbred the yarde, then to make the crossepeece thereof, take a table or planke of good woode, whiche shalbe so muche in length, as shalbe the Diameter of the halfe circle, and so muche in breadth as threetymes the thickenesse of the yarde, and of thyeckenesse two syn-

## The thyrde part.

gers or litle lesse. On the one syde also it must be very playne, and on the other syde in the myddest, it must haue a square or quadzature of al þe thickness of the plank, and from the square to the ends, it must be made thinner and thinner, so that it haue in maner the fourme of suche pickars where with milstones are picked. And in the myddst (by longitude and latitude) it must haue a square boale, by the which the yarde may enter fast, & make ryght angles with the crosse peece. And the point of the yarde must enter by the plaine syde of the crossepeece, & come forth of the square side thereof.

To take the  
altitude of the  
starres.

To take the altitude of the North starre, or any other starre on the Sea (for it serueth not on þe lande nor for the sunne, except the sunne shalbe vnder anye thynne cloude, & the Horizon clere) you shall put the heade of the staffe to the corner of your eye, rayling it vp, or putting it downe, vntil the nether part of þe crosse peece come with the Horizon: and being so, if the higher part of the crosse peece shall come with the starre, you muste looke the playne side of the crosse peece in what nuber



of degrees of the staffe it falleth, and those degrees shall be the altitude of the starre: as, yf the crosse peece reache not to the starre, you must bying the crosse peece nearer to your eye, vntyl the one part thereof come with the Horizon, and the other with the starre, & the degrees whiche it sheweth, shalbe the altitude.

The .x. Chapter, of the altitude of the Pole,  
known by the altitude of the North starre.



I know the paralel in the which the ship is, ouer and beside the rules here befoze of the altitudes of the sunne: it is lyke wise known by the altitudes of the North starre. These two manners are vsed, for that more credite is geuen to two witnessses, then to one. So that if by one argse any doubte, y same may be certified by the other: and also because time may sometime serue for the one, and not for the other. As, to haue a cloudie morn day or noone, and a cleare nyght.

The altitude is taken of the North starre, whiche is a starre in the extremitie or ende of the tayle of the lesse Beare, being a constellation, commonly called the Horne. For this North starre (of the mosse notable starres about the Pole) is nearest vnto it, and shall therefore shewe a lesse circle then any of the other, and so shall his altitude differ litte from the altitude of the Pole. This starre hath declination 85. degrees, and 51. minutes: and the complemente to 90. (whiche are 4. degrees, and 9. minutes) is his distaunce from the Pole. And although the maryners holde opinion, that it is not distaunt more then thre degrees and a halfe, yet to my iudgement, more credite ought to be geuen to the Astronomers, then to the maryners: for as muche as the Astronomers doo knowe the places of the starres, with theyr longitudes, latitudes, declinations, and right ascensions, more perfectly & precisely then doo the maryners. For they accompte not onely by degrees, but also by minutes and secondes. But let none deceaue them selues through my opinion.

h. ij.

Therefore

The North  
starre.  
The lesse  
Beare.  
The Horne.

The distance  
of the North  
starre from  
the Pole.

### The thirde parte.

Therefore, whosoever wyll precisely knowe it, let hym take the hyghest altitude of the North starre, whiche is, his being ouer the Pole : and the lesse altitude, whiche is his being vnder it . Then take awaye the lesse from the moze, and the halfe of that that remayneth, shalbe the distaunce of that starre from the Pole of the worlde. And lykelysse by this experience, may be knowen the altitude of the Pole, and what all the other starres that goe not downe vnder the Horizon, be distaunt from it. Joyning the greater altitude with the lesse, and that shal amount thereof, diuided by the halfe, shalbe the altitude of the Pole : and takyng awaye this altitude of the Pole, from the greater altitude of the starre, or the lesse from the altitude of the Pole: the rest that remayneth, shalbe the distaunce of the starre from the Pole. And as the Pole is inuisible, it can not be seene or knowen, when the North starre is hygher or lower, excepte it be by the meane of some other marke: and so; this is considered the position of the former guardes or watch, being one of the two starres called the garde, whiche are in the mouth of the Bozne . The maryners haue noted eynht positions from the former garde starre, to the North starre, whiche aunswere to the eynht principall wyndes . And as the garde is to the North starre accordyng to the placeynge of these positions, so shal it be hygher or lower from the Pole. Let vs here put the common rules which the maryners vse, to complie with those that are of opinion of the three degrees & a halfe. And so; the opinion of the Astronomers (which is the distaunce of .4. degrees, and .9. minutes,) I wyll hereafter geue a circular figure with a mooneable bozne : then the eynht wyndes of the eynht positions being marked, and puttyng the garde and the North starre in euery of the wyndes, it shalbe the distaunce that the North starre is hygher or lower from the Pole.

The Pole is inuisible.

The two starres called the guardes of the north star.

Common rules of the maryners.

#### Common Rules.

The former garde being in the East, the North starre is in one degree and a halfe vnder the Pole.

The

The Guarde begyn in the Northeast, the North starre is three degrees and a halfe, vnder the Pole.

The Guarde being in the North, the starre is three degrees vnder the Pole.

The Guarde in the Northwest, the starre is halfe a degree vnder the Pole.

The Guarde in the West, the starre is one degree and a halfe aboue the Pole.

The Guarde in the Southwest, the starre is three degrees and a halfe aboue the pole.

The Guarde in the South, the starre is three degrees aboue the Pole.

The Guarde in the Southeast, the sayde North starre is halfe a degree aboue the Pole.

Note that these eyght wyndes, are made accoꝝdyng to foure lynes. Whereof two are ryght, which are North and South, and East and West: and the other two are crooked, which are Northeast Southwest, and Southeast Northwest. When the Guarde and the North starre shalbe in the ryght lyne, it shall appeare cleare how they are: and when they shalbe in the crooked lynes, it may be seene, because the Guardes are the one by the other in a ryght lyne.

To see by Theorike or Speculation, howe the North starre ryseth vp, and goeth downe from the pole of the woꝝlde, I wyll here describe the sayde circular figure or instrument, which is a circle in whose circumference are written the eyght wyndes. The North in the hyghest place of the instrument, whiche they call the heade, and the South in the neather part therof, whiche they cal the foote: the East in the ryght arme, the West in the lefte arme, the soure reste, betweens these in their places. And here is to be noted, that the lynes whiche passe not thꝛough the center, are of the wyndes of their equidistances, that passe thꝛough the center. Within this circle, is an other litle circle, whiche describeth the starre of the North, by the mouyng of the sytle moveable, and hath so: his center the pole of the woꝝlde, as hath the sytle. This litle circle hath so: his Diameter eyght de-

The eyght  
principall  
wyndes accoꝝ-  
dyng to foure  
lynys.

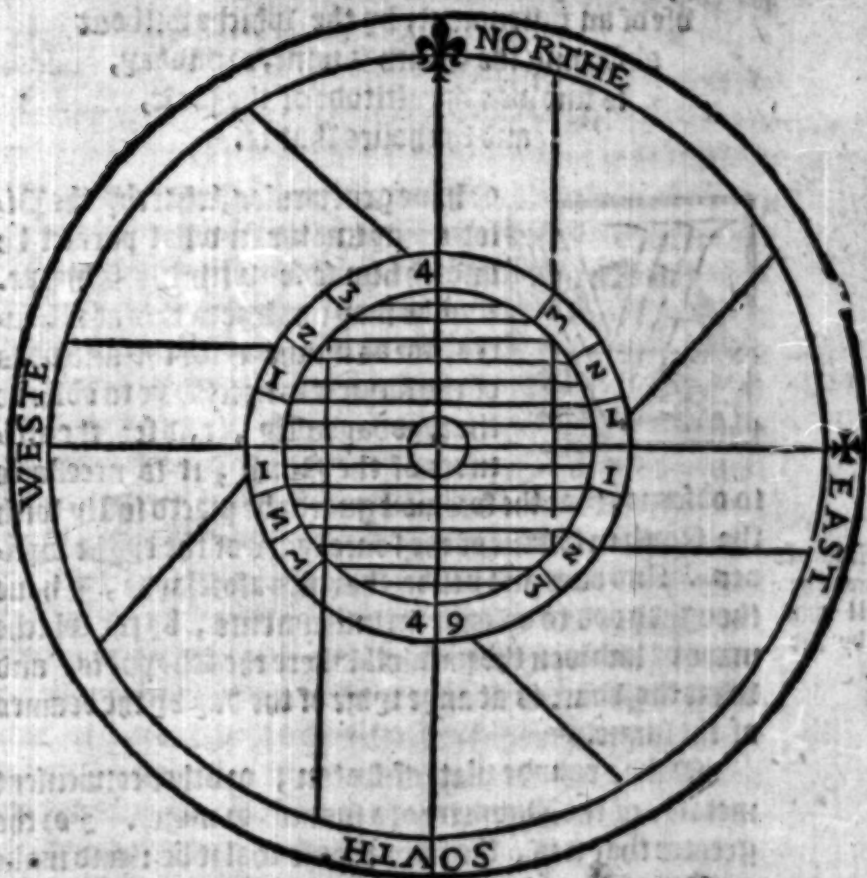
An instrument  
to know the  
rysyng or set-  
tyng of the  
North starre  
from the pole  
of the woꝝlde.

## The thyrd e part.

The hozne of  
the seven star-  
res.

Worthwhile  
to mariners.

degrees and eyghtiene minutes : as foure degrees and  
nyne minutes aboue the pole, and the other foure de-  
grees and nyne minutes vnder it. And they are diuided  
by certayne lynnes equidistant to the East and West. In  
the center of this circle, is annexed a hozne, with his seven  
starres, moueable rounde about by all the wyndes.  
And seepng them in heauen, holwe, and in what wynde  
they are, euen so in this fygure shall we see the North  
Starre, in what part it is of the degrees hygh or lowe  
from the pole : and that the wyllotte or Mariners shall  
not erre, I say that he ought not to put the sojerguarde in  
the wyndes that passe throughe the center of the fygure,  
so; it shalbe North and South with the pole, and not  
with the starre of the North, as it ought to be, and so of  
the other wyndes. And in this manner the starre of the  
North, shall shewe in the lynnes equidistant from the lesse  
circle, the degrees & partes of degree that it is higher or  
lower then the pole of the worlde: so; the same course, di-  
ferences, and variations, it maketh in heauen.



Thus being knowne howe muche the North starre is  
 vnder or above the Pole, let vs take the altitude thereof:  
 and that of it that is vnder the Pole, let vs ioine to his  
 heyght: and as muche of it as is above, let vs take awaye,  
 and that shall reſe thereof, ſhalbe the altitude of the Pole  
 above our Horizon.

The altitude  
 of the Pole  
 above the  
 Horizon.

R. l. iij

The

## The thirde part.

The. xi. Chapter, of the composition and  
vse of an instrument, by the whiche without  
observing the South Sunne, or midday,  
is knowen the altitude of the Pole,  
and the houre that is.



We haue geuen rules, whereby the Pil-  
lote may knowe in what paralel he  
findeth him selfe with his Shyppe.  
But he may not know this at al hou-  
res, for as muche as for the altitudes  
of the sunne it is necessarye to obserue  
the mydday iustly, and for the alti-  
tudes of the North, it is necessarie

to obserue, that the foremost garde be placed iustly with  
the North in somme of the foure lynes of the eyght wyin-  
des. And ouer and beside the rules aforesayde, I haue  
thought good to describe an instrumente, by the whiche  
maye be knowen the paralell where the Shyppe is, and  
what the houre is at anye tyme of the day by the beames  
of the sunne.

In instrument  
to knowe the  
paralell and  
houre by the  
sunne.

Make a rounde plate of Laton, or other convenient  
metall, of the Diameter of a spanne, or more. For the  
greater that it is, the more precise shal it be: and make  
in it two Diameters, that maye cut them selues in ryght  
angles vpon the center: In the foure extreames, or endes  
of these Diameters, leaue foure rounde punctes or por-  
tes, that may serue for axes. The one of these Diameters,  
shalbe called the axes of the worlde: and the other, the  
lyne of East and West. This done, make of the same la-  
ton a semicircular peece, of the thynknesse of the plate, or  
lytle lesse, and of the breadth of halfe a finger, this  
must stande vpon an edge, so that the contrary parte maye  
come iustly with y<sup>e</sup> halfe of the circumference of the plate,  
to the whiche it must be nayled or sothered in the neather  
part of the plate, the semicircle being rayled, and that the  
endes thereof may come with the endes of the axes of the  
worlde. And this semicircle shall you diuide into two e-  
qual partes, and euery halfe into 90. degrees, beginning  
from

from the halfe poynte towarde the ende of the axis of the worlde, whiche are the Poles.

In like manner shall you make two circular peeces, of the bygnesse of a peece of foure ryals of plate, whiche they cal rundels, for the houres : these muste be made faste in the plate by the Poles of the worlde, whiche maye holde or beare them by their centers. And euerye of these rundels must be diuided into.24. equall partes, and although not al, yet the vppermoste parte of the plate. And aboue in the highest poynte of these diuisions, you muste wyte 12. because that there it shall shewe the mydday or noone. And from thence, the afternoone houres muste begynne theyr numbers towarde the West parte, and shal ende.6. houres in the halfe or myddell of the ioynt of the circle with the plate. In the other ioynt of the other parte, shall begynne.6. of the houres befoze noone, and shal ende.12. in the byghest poynt. You must also make another Semicircular peece, of the bzeadth of a finger, this muste be playne or flatte, and the concauitie or holownesse thereof, equall to the Semicircle of the edge or side of the plate, and in the endes muste haue two holes, wherein maye iustly enter the poyntes that come forth of the circle, for the houres, whiche are the Poles of the worlde. Also, this Semicircle must haue two lynes, one, on the vppermost part, and the other, on the neathermost, which maye diuide the bzeadth into two equall partes. This halfe circle lykwys muste be diuided into two equall partes by longitude, with a trauesed lyne, whiche shalbe called the Equinoctiak: and from this lyne, to the inward parte thereof, muste be counted.23. degrees and a halfe towarde the one parte, and as muche towarde the other parte of the.90. that euerye halfe of the circle conteyneth. And at euery part where ende the.23. degrees and a halfe, make a trauesed lyne, so that from the one to the other, may be.47. degrees. And in this spase shall you drawe certayne lynes equidistant with them of the myddell, that they and the myddle lyne, maye diuide into.4. equall partes the bzeadth of the halfe circle. Then looke in the table of the declinations of the sunne, what declinatio-

## The thirde part.

on haue the .5. degrees of Aries, and that shall you account from the Equinoctiall towarde the one parte, and as muche more towarde the other, making a lyne that maye trauerse that of the myddest, where that declination dooth ende and touch in the other two lynes. And the same shall you doo at .10. .15. .20. .25. and .30. whiche is the ende of Aries, and beginning of Taurus: and then the lyne shall trauerse all the breadth. The lyke also shall you doo to Taurus and Gemini: then in the spaces, write the caracteres of the .xii. signes, beginning Aries from the Equinoctiall, towarde the North Pole. And then doo Taurus and Gemini ende in the greatest declination, beginning Cancer in the other parte of it. Then Leo and Virgo doo ende in the Equinoctiall, where shall beginne Libys, Scorpio, Sagittarius: And in the other parte, Capricornus, Aquarius, and Pisces, shall ende in the Equinoctiall where Aries beganne. This halfe circle must haue an opening, or open place, euen and iuste in the myddest from the Equinoctiall, vnto some what more then the greatest declinations: and muste be a litle broader on the inner parte, then without, and not so broad as may come to the two lynes, because it woulde then take awaie the graduation of the signes. And in this open place muste be put a square grayne or stubbe, whiche on the inner parte maye comme playne with the halfe circle, and on the vtter parte maye comme footb a litle, where shalbe nayled a square peece of Laton, of the breadth of the halfe circle: This grayne or stubbe being so nayled with the peece, must haue in the myddest a hole, so smal, as maye receaue a lytle pyne: and by the center of this hole, must passe a lyne, which shal trauerse all the grayne. And this lyne shal serue to put the sunne, (whiche the hole representeth) in the degree of the signe where it is. This halfe circle where it goeth in the circumferences of the rundelles for the houres, muste be fylled on the one side vnto the lyne that is in the myddest, to marke it, and shewe the number of it. For the placing or setting of this instrumente, you muste cut a gyrdell or

The caracteres  
of .xii. signes.

The hole that  
representeth  
the sunne.

The placing  
or setting of  
the instrument.

ryng

ryng of laton, as thicke as the plate, and of the breadth of a synger, or lytle lexe: and so large, that of it maye be made a circle somewhat bygger then the plate, so that the plate and the Meridian maye easly be conteyned within it. This circle shalbe called the Horizon, which must be diuided into foure quarters.

In lyke manner muste be made two semicirculer peeces: and the endes of them must be nayled or sothered in the poyntes that diuide the quarters of the circle: and diuide the one from the other in two equall partes, making ryght spherall angles. And in this ioynt of these two peeces, muste be nayled or sothered a Pastell, the whiche at the one ende is diuided into two byanches or forkes. When shall you make a base or foote for the same, which in the vppermoste part thereof, shall haue a concanitie or holownesse, where maye be sette a saylyng compasse or a needle, touched with the Lode stone, and couered ouer with a glasse. And on the hyghest edges of this base, the two byanches of the Pastell shalbe made fast: & this Base, with the Pastell, the halfe circle, and the circle, shall be all one peece, whiche shalbe called the seate or frame of the Instrument. The Horizontall circle in the endes of one halfe circle, muste haue two hoales, in the whiche may enter the Axis that are made in the endes of the lyne of East and West.

The foote or  
Base of the in-  
strument.

Also you must take good heede when you sother or make faste the Pastell in the Base, that the North and South of the plate or Horizon, come with the North and South of the needle that is beneath: hangyng euer respect howe muche the needle doeth varye from the Meridian, by Northeastyng or Northwestyng. In the ioynte of the two halfe circles vppon the Pastell, muste be a poynt (called the Index or shewe) whiche shall shewe in the halfe circle, sothered in the plate on the neather parte, the degrees that the Pole is rayled aboue the Horizon.

The Index  
or shewe.

## The thyrde parte.

The placing  
of the Horizon.

For the perfection of this instrument, it shalbe convenient to set the Horizon very playne & equall at the time of the operation or practising with the instrument: and this may be done in two maners. Whereof the one is, hanging by a fine threde, at the center of the plate, a plummet made somewhat poynted at the neather ende: so that the

For the land.

Horizon standyng playne and leuel, the poynt of the plummet maye fall vppon the poynt of the index, and this maner is good for the lande. But for the Sea, you shal sother in the Horizon two Arres, little stubbes or endes commyng foorth. These shalbe put in the two opposite hoales of a circle of metall made somewhat strong, and this circle muste haue other two stubbes lyke wyse commyng foorth, and equally distant from the two hoales. These muste be sothered or nayled in two hoales of an other circle in lyke maner, and the other circle with other two stubbes, inclosed in a bore. If then the bore stande even and leuell, the poise or wayght shal cause the Horizon to stande leuell, although the shyppe sway or roule from syde to syde. The vse of this instrument is in this manner.

The vse of the  
instrument.

When you desyre to knowe the paralell in the whiche you are, and the houre that is, put the lyne that traueseth the grayne, in the degree of the signe in the whiche the Sunne is (whiche you shall knowe by the table of the place of the Sunne, in the seconde Chapter of the seconde part) and set the North and South of the plate, with the North and South of the needle. Then turne the moueable Meridian agaynst the Sunne, the foote of the instrument standyng faste: and rayse it, or put it downe in the plate, vntill the beame of the Sunne enter in at the hoale of the grayne, and fall in the center of the plate: and standyng so, beholde the index, and howe many degrees it sheweth from the Meridian, so muche is the altitude of the Pole. Then looke where the moueable Meridian sheweth in the rundell of the houres: and there shal you see the houre that is.

The altitude  
of the pole.

Here foloweth the demonstration.



## The thirde part,

### The.xii. Chapter, of the leagues that are runne for a degree, according vnto diuers courses.

To knowe the  
distance from  
one paralell to  
another.

The arke of  
the greater  
circle.

The altitude  
of the Pole,  
varying one  
degree.

The quarter  
seruing for the  
xii. Windes of  
the compasse.



**N** the fourth Chapter, I promised to  
geue a rule to knowe the distance  
from one paralell to another, sayling  
by whatsoeuer line or winde, excepte  
the East and West: For the which  
is to be vnderstoode, that the naviga-  
tion or course from one place to ano-  
ther, (according to the Cosmographers) ought to be by  
the arke of the greater circle: for that by this manner  
shalbe the shortest course: and this greater circle they  
diuide into 360. degrees: and all the distances that are  
from one place to another, they accompte by the degrees  
and minutes of this circle: and so sayling from North  
to South, to one degree of the variation of the heighth of  
the Pole, shall aunswere another degree of the greater  
circle in the superficiall parte of the water and lande. And  
therefore sayling by whatsoeuer other lyne, vntill the  
Pole dooth varie one degree of altitudes, we shall haue  
gotten more then one degree of the greater circle: and the  
degrees that aunswere to euery lyne or wynde, you shal  
see in the demonstration folowynge, which hath two pa-  
ralell lynes, which are East and West, and the line that  
cutteth them in ryght angles, which commeth forth of  
the center from the quarter of the circle that is made, is  
North and South, and then shall you see by this order,  
all the other wyndes, halfe wyndes, and quarters of  
wyndes, reduced to one quarter: For the selfe same ac-  
count serueth for North-east and South-west and North-  
west and South-east, and so of the halfe wyndes and quar-  
ters of wyndes that are equally distant from the lyne of  
North and South: and so this quarter shall serue for all  
the 32. wyndes of the compasse. Without this quarter,  
harde by the lyne, you shall sende two numbers, whereof  
the firste shalbe of the degrees, and minutes of degrees of  
the greater circle, which is from one paralell to another.  
The other number, shalbe the leagues, and partes of  
leagues

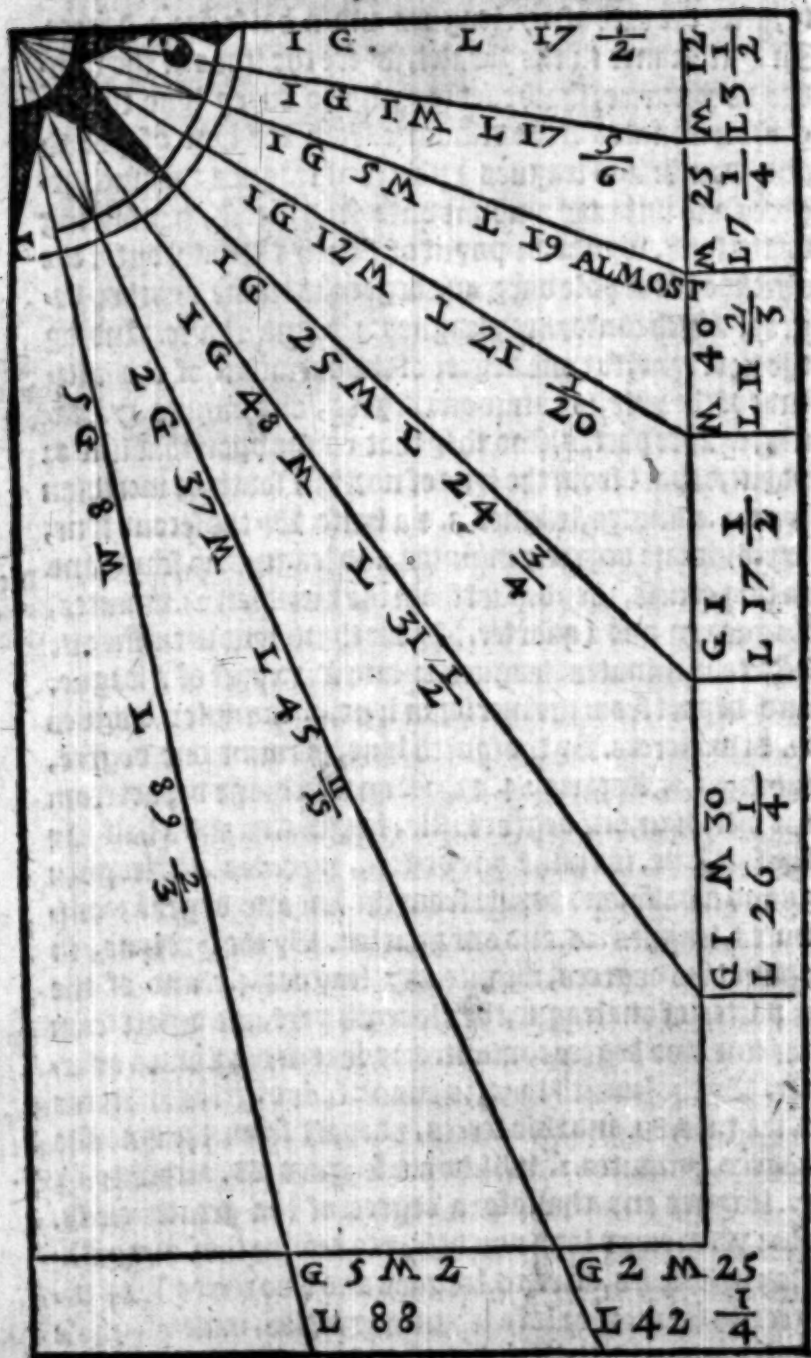
leagues that sache degrees and minutes do amount vnto, after the rate of 17. leagues and a halfe for a degree. In lyke maner in the paralel, where the lines of the win- des do concurre, shalbe set ioyntlye to euery lyne the de- grees & minutes of the distaunce from the lyne of North and South: and leagues & partes of leagues that sache de- grees and minutes amount vnto And so it is, that sayling by the lyne, wynde, or poynt of North & South, vntyl the altitude of the pole vary one degree, is runne another de- gree, which conteyneth leagues 17. and a halfe. And by the next lyne, for one degree of the variation of the alti- tude of the pole, is runne one degree, one minute. 17. leagues, & 5. syxt partes. And they that runne vpon that line or poynt, depart from the lyne of north, & south, or meridian lyne. 12. minutes, leagues 3. & a halfe. By the second lyne, is runne one degree, 5. minutes, and leagues 19. scant, and in this course, they depart from the meridian 25. minutes, leagues 7. and a quarter. By the thyrde lyne is runne one degree, 12. minutes, leagues 21. and a .20. part of a league, and depart from the meridian lyne, 4. minutes, leagues 11. & two terces. By the fourth lyne, is runne one degree, minutes 25. leagues 24. & three quarters, and depart from the meridian, one degree iustly, leagues 17. and a half. By the fyft lyne, is runne one degree, minutes 48. leagues 31. and a halfe, and depart from the line one degree 30. minutes, leagues 26. and one quarter. By the syxt lyne, is runne two degrees, minutes 37. leagues 45. and of the 15 partes of one league, the eleventh part, and depart from the line two degrees, minutes 25. leagues 42. and a quar- ter. By the seuenth lyne, is runne foue degrees, minutes 8. leagues 89. and two terces, & depart from the lyne foue degrees, minutes 2. whiche are leagues 88. accountyng 17. leagues and a halfe for a degree of the greater circle. And yf for euery lyne you desyre to knowe this computa- tion of leagues, after 16. leagues and two terces for a de- gree, or for more or lesse leagues or myles, multiply those such degrees by the number of the leagues or myles which enter into euery degree, and lyke wyse shall you number the minutes that are more then the degrees, by the same number

One degree of  
variation of  
the pole.

Departing  
from the Me-  
ridian line.

Degrees of  
the greater cir-  
cle.

# The thyde part.



number of the leagues that enter in every degree, multiplying the n by 60. and that that shal come of the division, you shall ioyne with the multiplication of the degrees, and that shall amount thereof, shalbe the leagues, and partes of leagues, that was in those such degrees.

¶ The .xiii. Chapter, howe to set or make a picke in the Carde of Navigation.



The Mariners call the picking of a point in the Carde, to set and appoint in it, in what point or part of the sea the shippe is in Navigation. For the performing whereof, it shalbe requisite that the pilot knowe

To knowe in what part or point the shippe is.

from what degree, or howe many degrees of the altitude of the pole he departed, and with what wynde he sayleth. And when he desireth to know where he is, let him know the altitude of the pole, by somme of the aforesayde rules. And yf taking the altitude, he fynde hym selfe in the same degrees where he was when he departed, his navigation hath ben from the East to the West, and what he hath gonne can not be knowen but by the iudgement of a wise and expert man, accordyng to the swiftnesse or goodnesse of his shippe, with consideration of the more or lesse tyme he hath had, as we have sayde before in the sixth Chapter. But if he fynde him selfe in more or lesse degrees, let hym take two payre of compasses, and put the foot of one, in the point or place where his shippe was when he departed, and the other in the lyne or wynde by the which he sayleth, and lykewise let hym set the one point of the other compass in the graduation of the Carde, in that number of degrees that he fyndeth the altitude of the pole, and the other point of the same compass in the next lyne of East and West: and so with both the compasses, one in the due bande, and the other in the other bande, let hym go ioyning them together, taking good heed, that the point of the compass do not swaue from the wynde wherby he hath sayled: neither the point of the other compass from the line of East and West, where he set it.

The altitude of the pole.

To fynde the distance by the Carde.

## The thyrde part.

Duerstmen-  
tes to the  
Plate.

And folowynge these two compasses by these two lynes, untill the poyntes of the two compasses loyne (that is to meane, the poynt that was set in the place from whence he departed, and the other that was set in the degrees that were found) then where these two poyntes do loyne, is the poynt where the shyp is. But (as we haue sayde in the first Chapter) they muste haue great respect to the wyndes and seas, and other thynges which experience sheweth them, to knowe if they haue gonne directly by that lyne, or if they haue fallen from it, and to what part. The which I remitte to the iudgement of men of good experience. From thence so;warde, they shall returne to keepe the same accounte, as when they departed from the haven, especially when they change their course.

**The.xiiii. Chapter, of the making and vse of an Instrument generall, to knowe the houres and quantitties of the day, and at what tyme the sunne riseth and falleth.**



Make a rounde plate with a ring or a handle aboue, as in *h* Astrolabe, drawing a lyne from the ring downeward passing through the center, and another lyne that may cut it in right angles through the center: And this last lyne shalbe called the Horizon.

Then shal you geue a circle vpon the center, leauing so much space betwene it and the edge of the plate, that therein may be written the numbers of the degrees: then also make another circle somewhat more within, leauing likewise a space where the graduations may be diuided. This done, diuide one of the best quadrantes toward the left hand, into 90. partes, which shalbe called the degrees of altitude, beginning the number of them from the ring, and ending the same in the Horizon. Then make another roundell somewhat less then this, in such maner that the degrees and numbers of the greater, remayne vncouered. And diuide this

lesse

lesse, by two Diameters into foure equall partes. And at the one ende of the one Diameter, leaue a poynt coming forth of the lesse rundel, cut directly with the same Diameter by the one parte, and this shalbe called the Index or thewer. In this rundel shal you make a circle halfe a finger lesse then the rundel. Then with a compasse take 23. degrees and a halfe from the Diameter, whiche signifieth the Equinoctiall: and whereas ende the 23. degrees, and a halfe for euery parte, make a ryght lyne from one poynt to another, so that this be a lyne of 47. degrees, and as muche more at the other ende of the said Equinoctiall. Wypon euery one of these ryght lynes, you shall make a halfe circle, and diuide euery of them into fyre equall partes, whiche may aunswere to fyre signes, and euery signe into thre partes, whiche maye aunswere to the tenthes or tenth partes of degrees: & if the instrument be great, you shal diuide euery signe into fve or more partes, so that you may make it perfect & pccise. This done, from the poyntes or prickes of the one halfe circle, to the poyntes of the other, drawe certayne lynes which shalbe equidistant to the Equinoctiall. In the endes of these lines, betweene the lesse circle & the edge of the rundel, draw also certayne lynes which may reach vnto the begynnynge & endes of the signes: and in the top of the endes, or ouer the endes of these lines, make an arch so farre distaunte from the lesse circle, as is the thiknesse of the edge of a peece of foure riall of plate: And in the space that is leaft, graduate the signes from ten to ten, or as the diuision shalbe. The space that remayneth from thence to the edge of the rundel, you shall diuide by the halfe, & in it shalbe made twelue spaces, where you shall set the signes with theyr names or caracteres orderly, so that Aries be nexte to the Equinoctiall: Then Taurus towards the part of the Index: Then Gemini. And turnyng towards the Equinoctiall, Cancer, Leo, Virgo. Lyke wyse on the other parte of the Equinoctiall, Libra, Scorpio, Sagittarius. And turnyng to the Equinoctiall, Capricornus, Aquarius, Pisces. And thus hauing signed the Zodiacke, you shall also signe or marke the heares in manner as foloweth.

The placing  
of the xii. sig-  
nes in the in-  
strument.

The zodiack.

# The thynde part.

Division of  
the Equinoctiall and Tropikes.

The houres  
is with they  
numbers.

The tryangle.

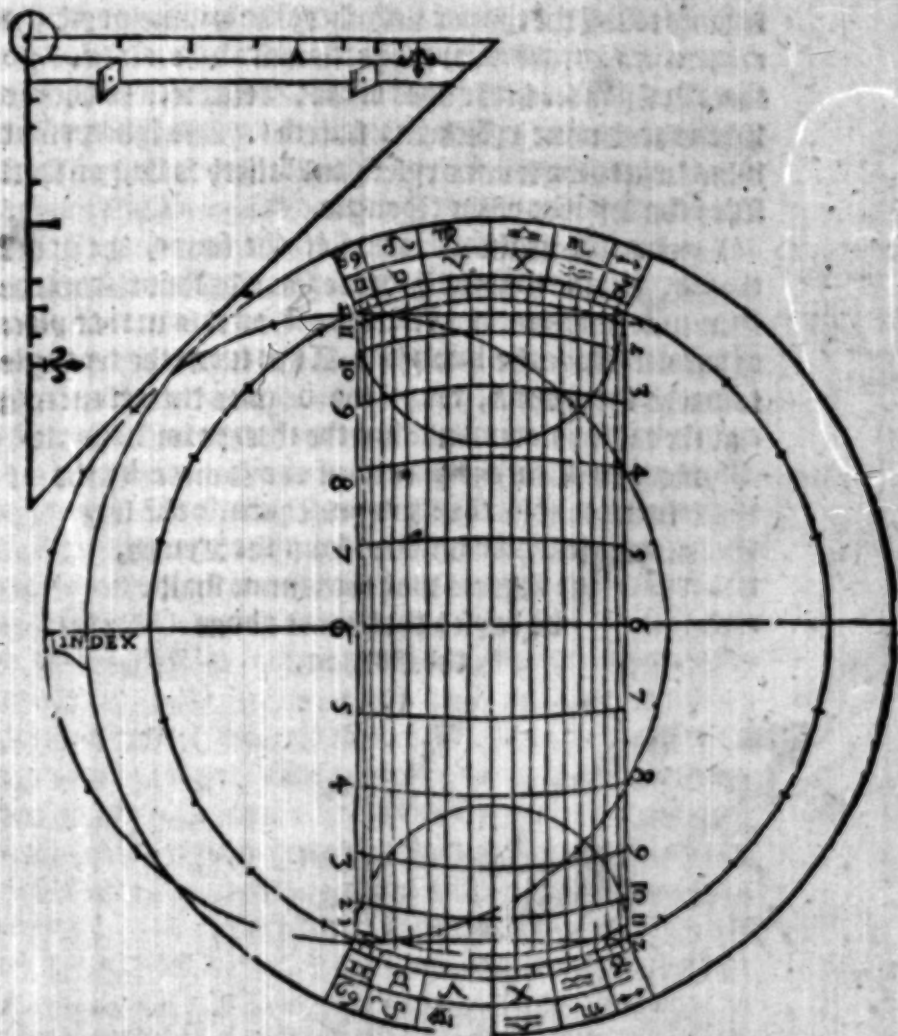
Division of  
the wyndes.

Divide the lesse circle of this rundell into foure equall partes, so that every quarter may haue spre partes. Reduce this division to the Diameter, putting the ruler vpon the poyntes, equally distaunt from the Horizon. And where it toucheth the Equinoctiall, make prickes or poyntes, so that the Equinoctiall remayne diuided into twelue partes. Then vpon one of the Tropikes geue a circle, which may haue the same Tropike for his Diameter. Divide this circle into .24. equall partes, and reduce these divisions to the Tropike, as is donne in the Equinoctiall, & from one Tropike to another: then the Equinoctiall and the Tropikes being thus diuided with these prickes or poyntes, you shal passe with a payze of compasses by every poynt equally ordered from the Horizon, to the one and the other part: and these shalbe calles houres, wytyng in the endes of them they numbers, begynnyng the one part in one, and endyng it in twelue. On the other parte, begynne the one in thopposite parte, and ende in twelue. This donne, these rundels shalbe brought to theyr perfection. Moreover, you shal make a tryangle, with a right angle, hauing two equall sides that maye make the right angle: Every of these sides must be as long as is the semidiameter of the greatest rundell: also, vpon and about the right angle, you shall make a litle circle, whiche shall haue the same angle for his center, & on the one side of this tryangle, set two rayed plates, as in the Astrolabe, on the contrary side of these rayed plates, must be a hole, so farre distaunt from the center of angle, as is the semidiameter of the circle of the lesse rundell. In this hole you must put a thynde, hanging therat a litle wayght or plummet, onely sufficient to holde the thynde draght, so that it cause no thing of the rundels to turne, or the instrument to declyne. Furthermoze, in a circle as bigge as the lesse of the lesse rundell, you shall diuide into .32. partes the eyght wyndes, and halfe wyndes, and quarters of wyndes. And being thus reduced to their Diameter (as is donne in the Equinoctiall) you shall translate them in the sides of the tryangle, in the which by the center of his litle circle, & by the center of the rundels, al the thyer pecces must be made

fast

fast with an ares o; a nayle, so that they may be turned a-  
bout close & very fast. Then put a rpng in the handle of the  
instrument, whereby it may hang, as in the Astrolabe : &  
so shal the instrument be finished & brought to perfection.

¶ This is the trace o; brought of the instrument.



# The thyrd part.

Division of  
the Equinoctiall and Tropikes.

The houres  
is with they  
numbers.

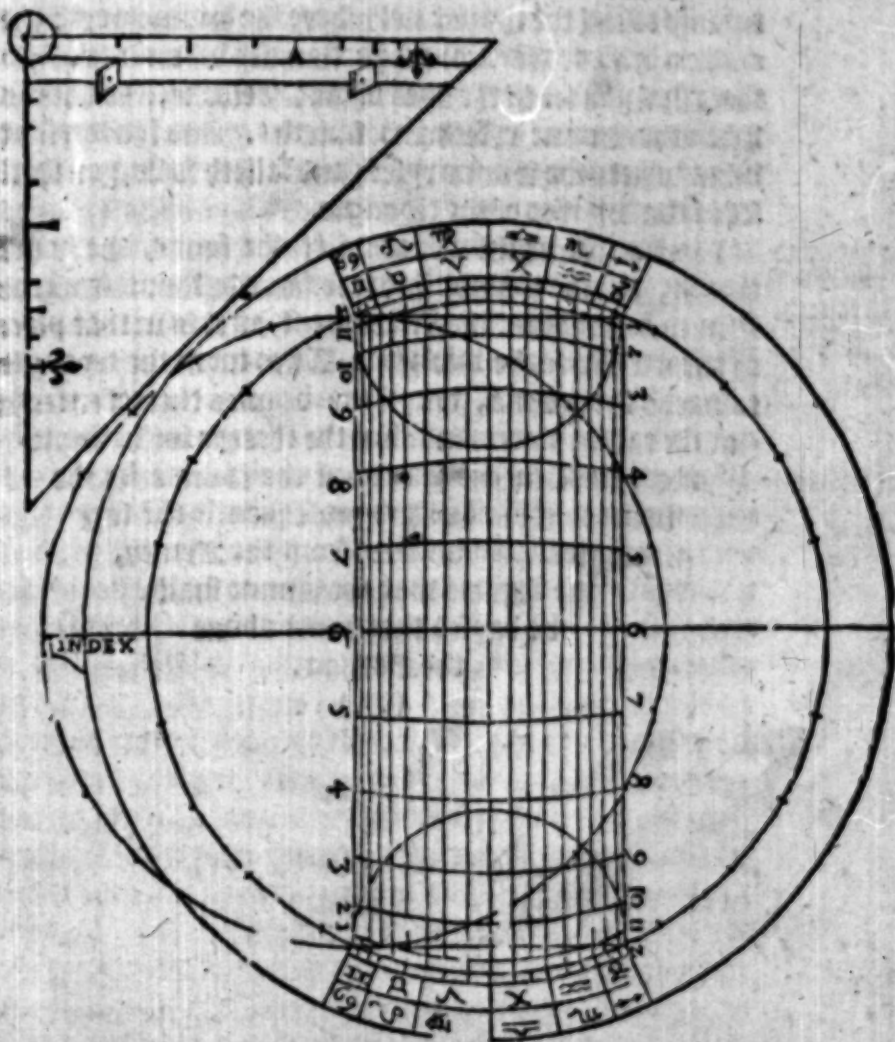
The tryangle.

Division of  
the wyndes.

divide the lesse circle of this rundell into foure equall partes,  
so that every quarter may haue fyve partes. Reduce this  
division to the Diameter, putting the ruler vpon the  
poyntes, equally distaunt from the Horizon. And where  
it toucheth the Equinoctiall, make prickes or poyntes,  
so that the Equinoctiall remayne diuided into twelue  
partes. Then vpon one of the Tropikes geue a circle,  
which may haue the same Tropike for his Diameter. Di-  
uide this circle into .24. equall partes, and reduce these di-  
visions to the Tropike, as is donne in the Equinoctiall, &  
from one Tropike to another: then the Equinoctiall and  
the Tropikes being thus diuided with these prickes or  
poyntes, you shal passe with a payre of compasses by every  
poynt equally ordered from the Horizon, to the one and  
the other part: and these shalbe called houres, wytyng in  
the endes of them theyr numbers, begynnyng the one  
part in one, and endyng it in twelue. On the other parte,  
begynne the one in thopposite parte, and ende in twelue.  
This donne, these rundels shalbe brought to theyr per-  
fection. Moreover, you shal make a tryangle, with a right  
angle, hauing two equall sides that maye make the right  
angle: Every of these sides must be as long as is the se-  
misdiameter of the greatest rundell: also, vpon and about  
the right angle, you shall make a litle circle, whiche shall  
haue the same angle for his center, & on the one side of this  
tryangle, set two rayfed plates, as in the Astrolabe, on  
the contrary side of these rayfed plates, muste be a hole, so  
farre distaunt from the center of angle, as is the semi-  
diameter of the circle of the lesse rundell. In this hole you  
must put a thierde, hanging therat a litle wayght or plo-  
met, onely sufficient to holde the thierde stayght, so that  
it cause no bing of the rundels to turne, or the instrument  
to declyne. Furthermoze, in a circle as bigge as the lesse of  
the lesse rundell, you shall diuide into .32. partes the eght  
wyndes, and halfe wyndes, and quarters of wyndes. And  
being thus reduced to their Diameter (as is donne in the  
Equinoctiall) you shall translate them in the sides of the  
tryangle, in the which by the center of his litle circle, & by  
the center of the rundels, al the thier peeces must be made  
saft

fast with an ares of a nayle, so that they may be turned about close & very iust. Then put a ryng in the handle of the instrument, whereby it may hang, as in the Astrolabe : & so shal the instrument be finished & brought to perfection.

¶ This is the trace of brought of the instrument.



## The thirde part.

**To knowe at  
what houre  
the Sunne  
risseth or set-  
teth.**

**To knowe at what houre the sunne risseth and falleth** (by the instrument folowynge) you shal put the pole of the lesse rundell (whiche is the index) to the leaste hande in the greatest rundell in so manye degrees above the Horizon, in howe manye degrees the Pole is rayfed in that lande or place. Then put the tryangle (whiche is the Horizon) in his place. That is to say, yf the Sunne shalbe in the North signes, put it to the least hande; and yf it shalbe in the South signes, to the ryght hande, and then the tryangle shall cut the paralel where the Sunne goeth, in 10. or 20. or 30. degrees, or proportionally where it is. And there shal you see in the sides of the Zodiacke, the houres when the Sunne risseth and falleth. And lyke wyse at what wynde the Sunne risseth and falleth to vs, you shall see in the wyndes of the tryangle.

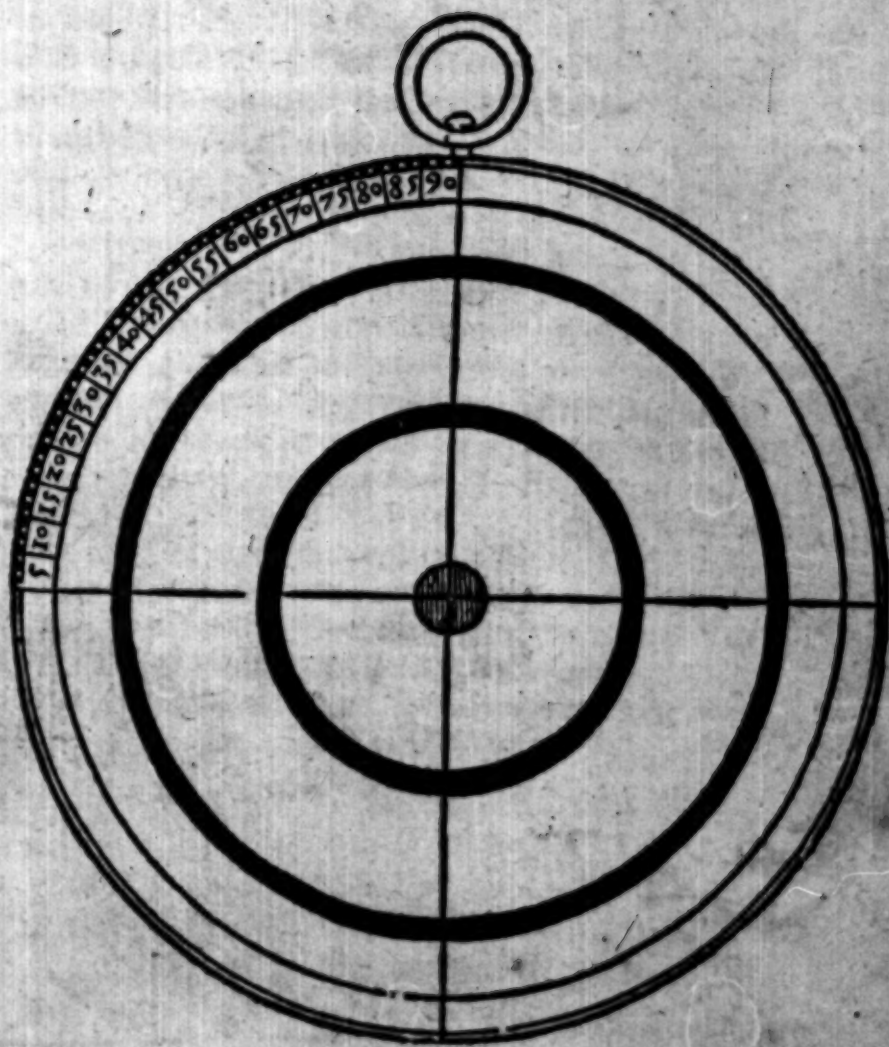
**At what wynde  
the sunne ri-  
seth or falleth.**

**To knowe by the elevation of the sunne, the houre that is,** put the Pole or Index so farre diskaunt from the Zenith or handle of the Instrument, as it is in that place or paralel above the Horizon: Then turne the tryangle towarde the Sunne, untill the beames thereof enter in at the rayfed plates, and then the threede with the plomet, shall cut the paralel of the Sunne by the houre that shalbe: and consequently the tryangle shalbe diskaunt from the Zenith, the degrees that the Sunne shall be rayfed that houre about the Horizon.

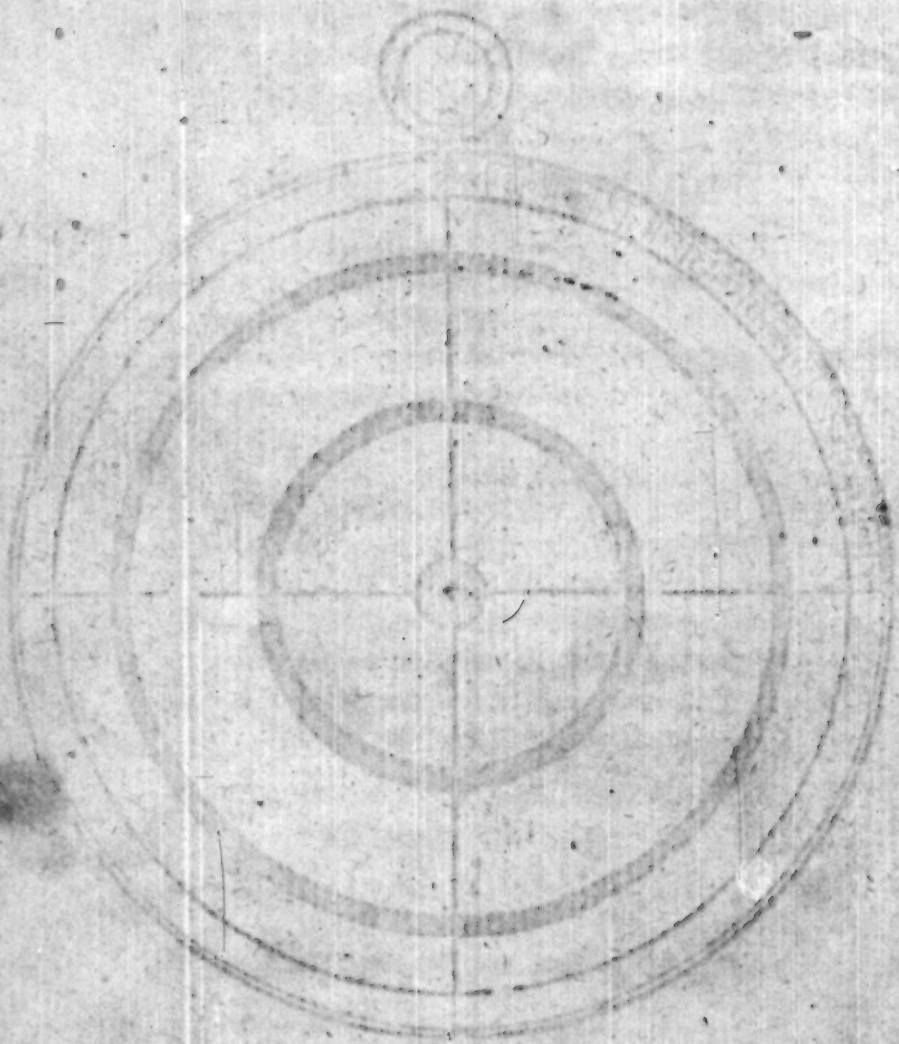
(.)

The thirde part,

¶ This is the Demonstration.



FINIS.



FINIS

Here beginneth the Table of this booke,

**T**he Contentes of the Chapters of the  
first part.

**T**he generall distinction of Creatures.  
folio iiii.

The definition of the worlde. fol. b.

The definition of the Sphere. fol. eodem.

The diuision of the worlde. fol. eodem.

The number, order, and propertie of the Ele-  
mentes and heauens. fol. vi.

The immutability or immobility of the earth.  
folio viii.

The roundnes of the earth and water. eodē.

The motion of the heauens and Elementes.  
folio x.

The diuision of the Sphere into formall  
partes. fol. eodem.

The equinoctiall circle. fol. xii.

The zodiack. fol. eodem.

The circles called Coluri. fol. xiii.

The Meridian circle. fol. xiiii.

The Horizontall circle. eodem.

The foure lesse circles. fol. xv.

The fīue zones. fol. xvi.

The Longitude and Latitude. And of the pro-  
portion whiche the lesse circles haue to the  
great circle. fol. xviii.

The circuit or compasse of the earth & water,  
acco:dyng to the opinions of the auncient  
and later auctours. fol. xix.

The. vii. Climates. eodem.

Certayne principles of this science. fol. xxi.

**M**i

**T**he

The Table.

The Contentes of the seconde part.

<b>T</b> he course of the Sunne in the zodiacke.	folio. xxii.
The true place of the Sunne in the zodiacke.	fol. xxiii.
The declination of the Sunne.	fol. xxv.
The entrance of the Sunne in the. xii. signes: and of the Equinoctials & Solstitials which diuide the foure times of the yere.	fol. xxvii.
Of the Moone and her motions and proper- ties.	fol. xxix.
The conjunctions and oppositions of the Sunne and Moone.	fol. xxx.
The declaration and vse of an instrument, by the whiche is found the place & declination of the Sunne, with the dayes and place of the Moone.	fol. xxxi.
The Eclipses of the Moone and the Sunne.	folio xxxiii.
Of Tyme & the definitions therof.	fol. xxxv.
Of the yere, and the diuers beginninges and reckoninges or computation had thereof in olde tyme.	fol. xxxvi.
Of the moneth & of his differences.	fo. xxxvii.
Of the weeke.	fol. xxxix.
Of the day and nyght.	fol. eodem.
Of houres.	fol. xl.
The making and vse of a vniuersall Dial for the day.	fol. xli.
Of certaine particuler Dials Mural and Ho- rizontal.	fol. xliii.
The composition and vse of an instrument for houres of the nyght.	fol. xlv.
The	

The tyme of the tydes, or rysing and falling  
of the sea. fol. xlviii.

Of certayne signes whiche prognosticate tem-  
pestes, or sayre weather. fol. l.

Of the bryght and shynnyng exhalations that  
appeare in tempestes, which the Mariners  
call Santelmo, or Corpus sanctum. fol. li.

The contentes of the third parte.

**T**HE number, order, and names of the  
wyndes. fol. lliii.

The composition of cardes for the sea.  
fol. lvi.

The vertue and propertie of the Lode stone,  
called in Latin, Magnes, and in Spanish,  
Piedrayman. fol. lxxi.

The makynge of the Mariners compasse for  
Nauigation. fol. lxxii.

The effecte and propertie that the compasse  
hath to Northeastynge or Northweastynge,  
whereby is knowen the variation of the  
compasse. fol. lxxiii.

The introduction and principles of the arte of  
Nauigation. fol. lxxv.

The makynge and vse of the Astrolabe, with  
the which the Mariners take the altitudes  
of the Sunne. fol. lxxviii.

The definition of the altitudes, and howe the  
altitudes of the Pole may well be knowen  
by the Meridian altitude and declination  
of the Sunne. fol. lxxxi.

The makynge of the Crosse stasse, where with  
M ii the

the Mariners take the altitude of the  
North starre. fol. lxxii.

Howe the altitude of the Pole is knowne by  
the altitude of the North starre. fol. lxxiii.

The composition and vse of an instrument, by  
the whiche without obseruing the South  
Sunne or mydday. is knowne the altitude  
of the Pole, & the houre that is. fol. lxxvi.

Of the leagues that are runne for a degree, ac-  
cording vnto diuers courses. fol. lxxix.

Howe to set or make a pzieke in the carde of  
Navigation. fol. lxxx.

Of the making and vse of an instrument ge-  
nerall, to knowe the houres and quantities  
of the day, and at what wynde the Sunne  
ryseth and falleth. fol. lxxxi.

FINIS.

Imprinted at Lon-

don in Powles Churchyarde, by

Richarde Iugge, Printer to the  
Queenes Maiestie.

Cum priuilegio Regiæ Maestatis.

THE  
LIBRARY  
OF THE  
MUSEUM OF  
ART AND  
ARCHAEOLOGY  
OF THE  
UNIVERSITY OF  
CAMBRIDGE

Imprinted by  
J. B. G. & Co.  
Printers  
No. 10, St. Paul's Churchyard  
St. Paul's, London